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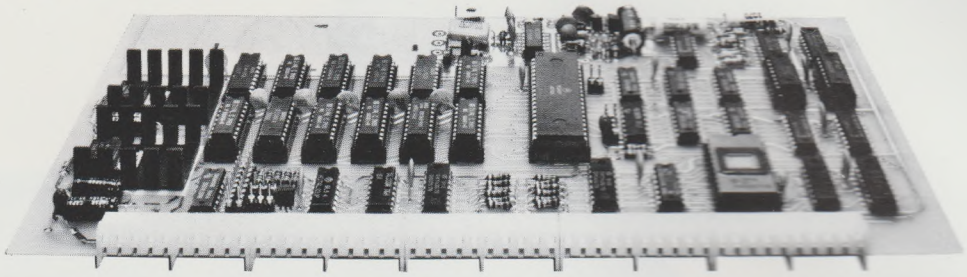

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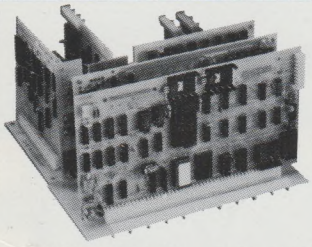

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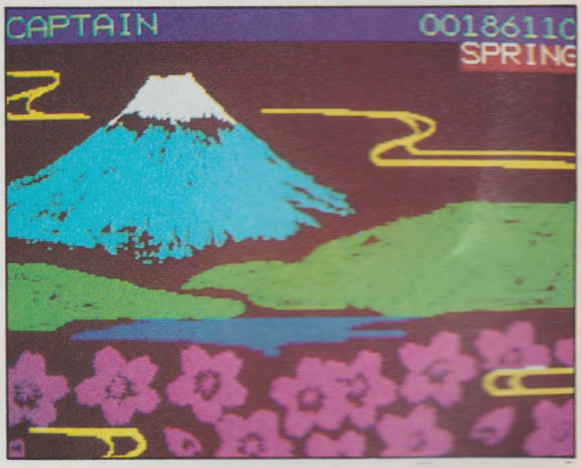

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This month:

The editorial staff of *Kilobaud Microcomputing* receives many requests for copies of the magazine's editorial calendar. Public relations firms, advertisers and manufacturers—to help plan their promotional activities for the upcoming year—are naturally anxious to receive copies of our editorial schedule. Our writers, too, need to coordinate their writing efforts with the special issues scheduled.

Since, for the most part, *Kilobaud Microcomputing* is written by its readers, we are publishing a list of some of the major topics to be covered during the coming year. Please note that this schedule is subject to change. Editorial material should be received by the 25th of the month three months prior to the date of publication (e.g., Oct. 25 for the January issue).

So, at the risk of tipping our hand and revealing our strategy to the competition, we include the following editorial calendar to help you plan your writing schedule for the coming year. Choose a topic and start writing.

December—A look at the microcomputers recently released by IBM and Xerox
January—Micros used in scientific applications
February—Languages
March—Artificial intelligence
April—16-bit microprocessors
May—Local networking
June—Computer crime
July—Speech synthesis
August—Micros in business
September—Education
October—Hardware construction projects
November—Micros as appropriate technology (e.g., alternative energy systems and humanistic applications).

—The Editors

This month's cover:

Photo by Lighthearted Studio.

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Medical Breakthrough

Doctors Computerize Practice

Health Care and the Microcomputer

We are all only beginning to discover the real power of the microcomputer. Here I am not referring to computing power, though that continues to grow with no end in sight—machines can be picked up at a local computer store with 256K bytes of memory on board, 16-bit processors are already a fact of daily life (32-bit processors can't be far around the next bend) and hard-disk drives have arrived. As impressive as the relentless growth of computing power is, the real power of the microcomputer lies in its versatility as a tool for man—the easy way in which that computing power can be remolded into a variety of tools for various applications.

The Proteus Machine

A single microcomputer can appear to be different things to different people—a word processor, a video game unit, a learning aid, a records storage and retrieval system and so on. (The list seems to lengthen daily.) Any one of the popular microcomputers can do any of these things and much more, depending simply on the software being used.

It is this ability to change hats at the insertion of a floppy disk that makes the microcomputer such a powerful tool in many settings. Perhaps nowhere can more of the microcomputer's abilities be used than in the health-care industry. Providers of health-care services (doctors, dentists, clinics, etc.) have a number of problems in common with other professions and small businesses—bookkeeping, billing and calculating employees' salaries, to mention a few. There are a number of fine microcomputer software packages available to help with such tasks. But there are a number of more interesting problems peculiar to the health-care industry.

Medical Networking

Such a network would give a physician immediate indices of the latest medical articles. It could be used to put doctors in contact with one another in new ways. Instead of having to consult a specialist by telephone or in person and mailing or delivering patient records, the necessary information could be transmitted via the network. The specialist would have it immediately, and could review it at his first opportunity, then transmit his recommendations back to the requesting physician. This might not only increase the efficiency of delivering medical care, but also help to decrease the cost of such care.

Perhaps nowhere can more of the microcomputer's abilities be used than in the health-care industry.

A network of this sort could also give doctors access to expert programs that are being developed by several researchers. Such programs reproduce the special diagnostic skills of medical specialists. These programs collect data on a patient's symptoms, case history, test results and so forth. Acting much like a human diagnostician, the program then decides which possibilities to delve into, asks specific questions about a possible illness and then suggests a diagnosis.

Special Health-Care Problems

Some of these problems have to do with handling several different kinds of insurance forms, maintaining up-to-date appointment schedules and dealing with extensive patient records. Two articles in this issue address this class of problems. There seems to be little commercially-available microcomputer software to aid the health-care professional in this area. But much can be done by modifying existing software, and a number of practitioners (doctors and dentists) who have developed their own software are usually willing to market or in some way share it. If a doctor or dentist wants a computerized office, it is no longer necessary to become (or hire) a programmer to design a special system. And it should be getting easier. (In fact, we hope to keep you aware of what is available and how further information can be obtained.)

There is another group of medically related problems that the microcomputer can also help solve. It is often necessary for a doctor or dentist to seek expert advice on a diagnosis or therapy. Traditionally, this has been handled by either consulting with a specialist or studying medical books and journals.

Computers can aid in this process in a number of ways. A special medical network that physicians could access by using an office microcomputer in a terminal mode (which makes the computer act like a terminal) could put an immense amount of information at their fingertips.

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META NOTATIONS. . .

MTC introduces its FREE computer "bulletin board" service. Set up your terminal or terminal software for 300 baud, parity disabled, 8-bit word length, and 1 stop bit. Dial (216) 289-8689. After the connection is established, type LOGIN META. When asked for a validation code, type META. Have fun!

* * *

In a couple of months MTC will introduce the successor to AIDS-III/CALCS. It is called AIDS/P™ and is based on MTC's PRIMAL™ (Practical Relational Information Management Applications Library), a powerful system for PRIME minicomputers. AIDS/P features the best of the critically acclaimed AIDS-III/CALCS but is probably an order of magnitude beyond it in power. It will be first made available to AIDS-III/CALCS owners (for an upgrade charge), then to the general public. Price will be in the $200-$300 range.

* * *

Effective September 1, 1981, Metatronics Corporation became a subsidiary of MTC. Metatronics will carry the complete MTC product line in addition to its own. Order processing and fulfillment departments have been combined to improve service response levels. MTC's superior software and supplies marketing, and Metatronics exceptional peripheral offerings should prove to be a fomidable combination. (Sorry guys, if you can't beat us, join us . . .)

* * *

MTC now offers a more complete selection of diskette products (ad deadlines prevented inclusion in anything but this column). New manufacturers are MAXELL and 3M. Definitely call for specific information. For example, MAXELL Brand 5¼" diskettes in a PLASTIC LIBRARY CASE are only $34.95 for a box of 10! SCOTCH Brand diskettes are comparably value-priced. MTC is also introducing its own PARAGON™ Brand media products. The intent is to offer a super-high quality product at a very competitive price. For example, a box of 10 single-sided, soft-sectored, double-density, 100% certified diskettes with HUB RINGS is only $24.95! A full line of products (including HEAD CLEANING KITS, etc.) will be offered. The PLAIN JANE™ (almost 200,000 units sold) diskette line will become part of the PARAGON™ MAGNETICS operation (but don't quote us verbatim).

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A physician who had a computerized office could most efficiently make use of such programs via a network. He could transmit the computer-recorded case file of the patient in question to the expert program, possibly answer a few questions and receive a recommended diagnosis from the program.

These are not original ideas. Neither are they futuristic dreams of what might be available some day. The technology for such systems is available today. All we lack is sufficient impetus to put the parts together.

Patient Education

Interactive programs exist which ask for information about the user's lifestyle and habits, then give the user information about possible health hazards and life expectancy. This kind of interactive program, if available in a doctor's or dentist's office, could aid the practitioner in educating patients about specific medical situations. Interactive educational programs would also be a great service to patients and their families, who could obtain accurate, current information when needed.

Monitor and Control Systems

Dedicated microcomputer systems (small systems designed to do one job, but do it continually) have been around for a while and are beginning to appear in health-care environments. These systems may consist of "off the shelf" computers and peripherals or of specially designed inexpensive single-board computers.

Small dedicated systems can be used in hospitals to monitor and record patient "behavior"—brain-wave patterns, chemical levels in the body, etc. They can also be used to monitor and control laboratory tests. The possibilities of using microcomputers in this way are also open-ended and exist right now.

In The Months Ahead

We will continue to bring you more information on work being done with microcomputers in medicine. Articles will range from accounts of small dedicated systems designed for specific control and monitoring tasks in patient care and laboratory test analysis to programs designed to help physicians make fast, accurate diagnoses in problem cases.

Concern is often expressed that health care has become increasingly impersonal. Here, and in following issues, we will look at ways microcomputers can serve our physicians and allow them to provide more efficient patient-oriented health care. We won't be seeing computers replacing our doctors; we will see computers helping them provide more personal medical care.

We have only scratched the surface and introduced the subject in this issue. Since health care is a vital concern to all of us, patient and practitioner, we will regularly look at new medical applications of microcomputers.

Harold Nelson
Technical Editor

SofDoc—A Medical Software Exchange

As physicians begin to develop an appreciation for the potential of the microcomputer, they apply their medical knowledge to the task of producing medical applications software. Many physicians try to market the result of their labors, but find that it is extremely difficult to track down other computing doctors. Enter SofDoc, a microcomputer software exchange.

SofDoc is the creation of Dr. James Gange of Los Angeles, California. Dr. Gange began SofDoc as a way to help some like-minded physician friends who all had some software that they were willing and eager to share with their colleagues. Since its inception about a year ago, SofDoc has been adopted as an official project by the Society for Computer Medicine, whose president is Dr. Marion Ball, the Director of Computer Services at the Temple University Medical School.

Microcomputers should have a profound impact on the practice of medicine.

SofDoc's current offering is a collection of approximately 25 programs. Included in the package, distributed on a 5¼-inch floppy disk, are:

- programs to evaluate pulmonary function
- programs to set up a respirator
- programs to generate evaluations of lab tests such as glucose tolerance and electrolyte balance
- three programs to evaluate a patient's lifestyle, help the patient figure out why he can't give up smoking and suggest ways to improve health by changing lifestyle habits
- the ANSI standard MUMPS program, the most commonly used medically oriented language

All of these programs are written in various dialects of BASIC (with the exception of MUMPS). The disk is available to physicians for $25. A physician can join SofDoc and receive the software for free by contributing software to the exchange. The programs will run on the Apple II and II Plus.

SofDoc is always on the lookout for new software and is looking for competent software editors and programmers, as well. Dr. Gange says the exchange can't pay editors at present, but can arrange to provide references in return for editing, translating to other BASICs and operating systems and debugging. SofDoc is not interested in business office software; the thrust of SofDoc is clinical application software.

In a recent interview with *Microcomputing*, Dr. Gange said that, theoretically, microcomputers should have a profound impact on the practice of medicine. Practically, however, says Dr. Gange, "This hasn't happened yet. The development of clinical applications is still in the embryonic stage." Dr. Gange speculated that growth in the field had been slowed by the difficulty in distributing medical software. This is one of the reasons he launched SofDoc (it is also one of the chief reasons for choosing this as the theme for this issue of *Microcomputing*).

For further information, write to SofDoc, c/o Dr. James Gange, 1433 Roszmare Road, Los Angeles, CA 90024.

G. Michael Vose
***Microcomputing* staff**

What to Expect From *Microcomputing*

We are probably not the only editorial staff that finds it necessary from time to time to ask ourselves questions like, "Who reads our magazine?"

We find it necessary because it helps us reevaluate whether or not the content and style of *Microcomputing* are appropriate for the people who are, or, in our perception, should be, readers of the magazine. If we don't give our readers information they need and want, they will have little reason to stay with us. All readers want material presented in a clear, readable style. Of course, what is readable for a student, a small-business person, an engineer and a Ph.D. in one of the humanities will not be the same, in most cases.

Style

Most publications would consider these individuals to represent four distinct audiences. For *Microcomputing* that is generally not the case. We do not view our readers as having reached some specific academic or professional level. We obviously see our readers as having a common interest in the area of personal computing. But we also view our readers as having attained various levels of sophistication in that area. This presents some unique problems.

Some of our material is directed toward the beginning computerist—whether a twelve-year-old student or a corporate executive. This material is aimed at the individual who has access (in the home, school or office) to a microcomputer but who has little experience working with

computers.

Other material presupposes some computing expertise on the part of the reader. This material is aimed at the individual who owns a microcomputer and knows what to do with it—at least for certain applications. Individuals of this sort, also, come in a variety of ages and from a variety of backgrounds.

How do we go about presenting material to readers of differing educational and professional backgrounds whose only common interest is microcomputing?

We do it, first, by striving for clarity. We don't think you should have to spend time trying to figure out what an article means. Also, we think it should be apparent from the beginning whether or not the subject of an article will be of interest to you and appropriate for your level of experience.

We will be working harder than ever to cut through the computer jargon that has grown up around the microcomputing industry. While much of this terminology serves as a kind of shorthand, most of it is confusing to the beginner. For example, a term like *baud*, which is a holdover from the prehistory of microcomputing, does not tell the neophyte that we are talking about the rate of serial data transfer. In fact, if he looks up baud in a technical dictionary, he is likely to find statements about units of modulation speed or the number of signal line changes per second. We have decided, following the example of other computing publications, to use more descriptive terms like *data rate* and *bits per second* in discussions of data transmission (which is what baud is generally used to mean anyway).

Other terms can be actually misleading. The term *RAM*, for example, is usually used as the opposite of ROM. In fact, RAM (which stands for random-access memory) is not the opposite of ROM (read-only memory), since almost all ROM used in microcomputers is random-access memory. The real distinction is that one type of memory can be programmed and reprogrammed from the keyboard by the user and the other has its program "burned" into it and cannot be reprogrammed from the keyboard (it can only be read).

Since these terms are so widely used, we have decided to continue using them but to remind the reader from time to time that when he sees RAM he should think *programmable random-access memory*. In fact, this represents the general way in which we will handle computer jargon and technical terminology. We will occasionally remind the reader what such terms are used to mean in microcomputing circles. This will introduce beginners to terms that they will encounter when dealing with other computerists, and, at the same time, will preserve the shorthand value of such terms.

Content

Another problem presented by what we believe should be our varied audience is that of article content. The material we present should cover the range of what is appropriate to the beginner to what is of interest and value to the moderately sophisticated computer user. And this range must be covered in a variety of areas—programs and programming, constructions and modifications, new applications, product reviews and so on.

How then do we choose material for *Microcomputing*?

A number of factors determine our choice of material for publication. Subject matter should appeal to as wide an audience as possible. While not all articles will be of equal value to all of our readers, we try to present articles in such a way that they will all be of interest to as many of our readers as possible. Of course, some beginners will not be able to follow all construction projects or advanced programming articles. (Hopefully, these readers will recognize some significance in such articles and save them for future use.) Other readers may not feel a need for some elementary tutorial articles. (But a certain amount of review is always beneficial, and these readers are often the providers and critics of our tutorial material, thus helping to keep us all up to date.)

There is and will be a good deal more consumer-oriented material than in the past.

We want the information we offer you—whether it is about people or events in the microcomputing industry, products, applications or hardware modifications—to be as current as possible. At the same time, we will occasionally bring you information on new applications or updating modifications for older equipment provided that the equipment is still readily available to our readers.

Microcomputers and computing have undergone quite an evolution in a very few years. Microcomputing has gone from a hardware-hackers hobby to a major consumer industry (and from all indications—IBM and Xerox have just joined the field—we are still at the very beginning). Accordingly, as many long-time readers have correctly observed, *Microcomputing* is also changing and growing. There is and will be a good deal more consumer-oriented material than in the past—reviews of new computers, peripherals, software and publications, for example. There will continue to be articles on new and interesting ways of using microcomputers. And you can expect to still find a good number of useful and just plain fun program listings in *Microcomputing*. We will, as always, be publishing quality articles on hardware construction and modification projects. There will, however, be some changes in the hardware articles we will be offering from those we offered in the past, again reflecting the changes in the field. Our criteria for hardware articles now include the following considerations:

- The material should be useful to a large number of readers.
- Components used should be readily available.
- They should offer something that is not commercially available or something that is commercially available but only at a much higher price than the costs incurred in the project.

We know our hardware articles have been useful to our readers in the past and we hope they will be even more so in the future.

Who Should Read *Microcomputing* and Why

Almost everyone who is involved with microcomputers—from the rank beginner on up—should read *Microcomputing*. We like to think that reading our magazine should be an education. It should help you get started and help you grow in sophistication as a microcomputer user. If you are an electrical engineer or computer scientist, you may not need us; otherwise, you almost certainly do need us.

We recognize that someday some of our readers will feel they have outgrown their need for *Microcomputing*. This is inevitable, and, in fact, in a way it is one of our goals. If you reach the stage where we are no longer teaching you, we hope that you will stay with us as a contributor and critic of what we are offering.

We are trying to give you, our readers, a unique service in *Microcomputing*. Whether or not you read another publication devoted exclusively to your computer, we offer you a general overview of the entire microcomputing field as well as many specifics about your own system. If you have or use a microcomputer, you really should read a good general-interest micro-oriented publication like *Microcomputing*.

There is a great deal happening in our field and we want to help keep you informed and up to date. We also would like to hear from you. Let us know what you like and dislike about the magazine, what you would like us to review and the kinds of articles you would like to see. This can only help us to serve you better.

Harold Nelson,
Technical Editor.

By Robert W. Baker

Word Pro Enhancement

Lets You Print Source Files

Word Pro File Printer

I put together this little program a few days ago (Listing 1). Its sole purpose is to print a Word Pro source file, something you currently cannot do with Word Pro itself. Word Pro only lets you print the formatted output; you can only save and restore source files to disk.

A nice side-benefit of this program is that you don't have to load Word Pro just to look at a few files. This avoids the inconvenience of having to kill Word Pro to reset the system.

I wrote the program for Word Pro 3, but it can be easily modified for Word Pro 4 and the 80-column machines. Simply change the value of LN in line 30 from 40 to 80. The value (LN) controls the line length. The value of LM (in the same line) controls an offset from the left margin before each line is printed. Its current value of 20 will center a 40-column line in an 80-column page. If you're changing the program for an 80-column machine, you should set this to zero, or eliminate the PRINT#4,SPC(LM) in line 300. The program is preset to only read files from drive zero as set in DR$.

Lines 40–130 get the file name of the desired Word Pro file and open the file as a sequential data file. Note that the older command channel disk commands are used. This lets you run to any disk with any appropriate BASIC.

Line 140 reads and ignores the two-byte program load address at the front of the file. Remember that the program load address is always passed as data whenever a program file is opened as a sequential data file.

Line 200 puts the CBM 2022/2023 printer in upper/lowercase mode as normally used for listings. Lines 300–380 then read the file character by character, using a GET# command. Each character is converted from its display (screen) value to its ASCII value for the printer. The back-arrow must be specially decoded.

At the end of each printed line, the keyboard is checked to see if you want to suspend output, quit or continue (lines 400–440). When the program is printing, hitting any key will suspend output and display a short message. Hitting Q at this point will close the disk file and end the program. Hitting any other key will con-

```
10 REM WORD PRO SOURCE FILE PRINTER
15 REM
18 REM       BY: ROBERT BAKER
20 REM
25 :
30 LN=40: LM=20: DR$="0:"
32 :
33 REM SET LN TO 80 FOR WORD PRO 4
34 REM SET LM FOR LEFT MARGIN OFFSET
35 :
40 INPUT"■ENTER FILENAME   ■■■";FL$
100 OPEN 15,8,15
110 OPEN 2,8,2,DR$+FL$+",PRG,R"
120 INPUT#15,EN,EM$,ET,ES
130 IF EN<>0 THEN 1000
140 GET#2,C$,C$
190 :
200 OPEN 7,4,7: PRINT#7: CLOSE 7
210 OPEN 4,4
290 :
300 PRINT#4,SPC(LM);: FOR X=1 TO LN
320 GET#2,C$: IF ST<>0 THEN 1100
330 C=ASC(C$): IF C=31 THEN C=C+192: GOTO 380
350 ON (C/32)+1 GOTO 370,380,360,370
360 C=C+64
370 C=C+64
380 PRINT#4,CHR$(C);: NEXT: PRINT#4
390 :
400 GET C$: IF C$="" THEN 300
410 PRINT "■■■PRESS ANY KEY TO CONTINUE, ■■■ TO QUIT"
420 GET C$: IF C$="" THEN 420
430 IF C$="Q" THEN 1200
440 GOTO 300
900 :
1000 PRINT:PRINT"■DISK ERROR
1010 PRINT EN;EM$,ET;ES: GOTO 1200
1100 IF ST<>64 THEN PRINT "■ERROR■   ST=";ST
1150 PRINT#4
1200 CLOSE 2:CLOSE 15: CLOSE 4
```

Listing 1. Word Pro source file printer.

Address correspondence to Robert W. Baker, 15 Windsor Drive, Atco, NJ 08004.

tinue the output. The program will normally quit when the end of the disk file is detected. Any disk errors will be reported and the program will terminate after closing the files.

New VIC Happenings

The second and third program six-packs for the VIC-20 are a math improvement package for grades 1 through 6 and a collection of business and calculation programs.

By the way, Commodore is color-coding their tapes and cartridges for the VIC so you can easily identify the class of program:

Red = Games and recreational
Blue = Educational
Green = Business and calculation
Black = Computing aids
Orange = Home utilities

Speaking of cartridges, about ten cartridges are now available for the VIC. Some of the first ones available include: Invaders, Night Driver, Slot Machine, a poker game and Programmer's Aid. A Super Expander cartridge should also be available; it includes an additional 3K of random-access memory (RAM) along with graphics plotting and music writing commands. It will also let you easily change the programmable-function keys.

One other note of interest: the VIC game port accepts Atari joysticks! Commodore took this route because they feel the Atari controls are becoming an industry standard. Now, if they can just add a few simple joystick commands like the Atari 400/800 support, we'll really have something! For the time being, you must resort to the familiar PEEKs to read the joystick from BASIC.

VIC–PET Tapes

The VIC-20 was designed to be somewhat compatible with the existing PET/CBM machines, with certain limitations. You need to take a few precautions when loading PET/CBM programs into a VIC, or VIC programs into a PET/CBM.

A standard BASIC program tape created on a PET/CBM will load into a VIC without any problems, assuming that the program is reasonably small in size and will fit into the somewhat limited memory space of the VIC. The VIC will actually load the program at the start of available memory and correct the program link addresses.

A machine-language program tape created on a PET/CBM will normally not load into a VIC—you'll usually get a load error. Even if you don't, the machine-language program will probably not function properly, if it will run at all. All low memory pointers and the entire operating system ROM have been changed in the VIC.

A BASIC program tape created on a VIC can be loaded into a PET/CBM, but a few POKEs are usually required before you can LIST or RUN the program. If you have a VIC without any memory expansion, BASIC programs are stored starting at location 4097 ($1601 hex).

When you load a VIC program into a PET, it will be stored at the same address. However, a BASIC program in the PET normally starts at location 1025 ($0401). Thus, you must do a POKE 41,16 on the PET to set the starting address for BASIC to match the VIC-20. Also, you must do a POKE 4096,0 to put a zero byte before the first byte of the BASIC program for the PET's BASIC operating system to function properly. Once these two POKEs are performed you should be able to list or run the VIC program in the PET as normal.

If you add the Super Expander cartridge to the VIC, then the starting address for BASIC programs will be lower. Actually, they'll start at the same address as on the PET. Any programs created on an expanded VIC-20 will then be directly loadable on a PET/CBM system without doing any POKEs.

The two different starting addresses for VIC programs may present a few problems, but there is a simple way to check a program tape before actually attempting to load it. This procedure will work on any Commodore system, but the addresses must be changed for the VIC-20 since its tape buffer has been moved.

First, mount the desired program tape in the drive (TAPE#1 if a PET/CBM). Then enter an OPEN 1 command on the keyboard and press the recorder play button. The program name will be displayed once it is found. When the tape stops and READY reappears, enter the following command to find the starting address of the program on the tape:

```
PET/CBM:  PRINT PEEK(635)+(256*PEEK(636))
    VIC:  PRINT PEEK(829)+(256*PEEK(830))
```

If you want to find the last address of the program you can enter:

```
PET/CBM:  PRINT PEEK(637)+(256*PEEK(638))
    VIC:  PRINT PEEK(831)+(256*PEEK(832))
```

This can tell you whether or not the program will fit into your machine without even trying to actually load it. Also, you can check that the tape is really a program by doing a

```
PET/CBM:  PRINT PEEK(634)
    VIC:  PRINT PEEK(828)
```

If the value displayed is a one, then the tape does contain a program and not a data file.

These PEEKs are actually checking the data contained in a file header on the tape that is read into memory by the OPEN 1 command. Every PET, CBM or VIC tape file (whether program or data) contains a header that describes the type of file, the starting and ending addresses of program files and the file name. An OPEN command simply finds the appropriate tape file, reads the file header and then stops the tape. You can open any type of tape file but you can't read a program file from tape as data.

Programmable VIC Characters

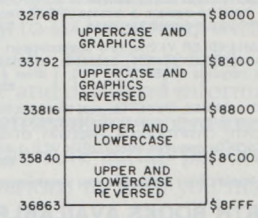
Remember that the VIC-20 has a programmable character set. The normal character ROM may be overridden by programmable character sets contained in RAM. To produce these programmable color characters, the VIC-20 uses three areas of memory: character pointers, display characters and color pointers.

The character pointer area contains a pointer for each particular character to be displayed. This table is referred to as the video matrix and is typically 506 bytes in length in RAM.

The character area consists of eight- or 16-byte blocks, called cells, which contain the actual dot patterns to be displayed. These character cells can be stored in ROM or RAM, depending on how they are to be used. This is the table that can be modified to create your own special character set.

The color pointer area is referred to as the color matrix. The four-bit color pointers define the color of any character to be displayed and selects one of the two color modes available.

The operating system organizes the video matrix, color matrix and character cells into the proper format to display the desired data on the screen. A typical video matrix defines 23 rows of 22 characters. This yields 506 character-display locations with a screen resolution of 176 horizontal by 184 vertical dots. Each of these character-display locations has a corresponding character pointer, or index, which points at a character pattern that is to be displayed at that particular location.



VIC character generator ROM.

At the time I was writing this column, Commodore was getting ready to release a programmable character editor program for the VIC-20. This program makes the creation of special character sets a real snap. You can save a character set on tape and later load it with a BASIC program for use in game graphics or whatever. A relocating loader that was still being developed is supposed to allow multiple sets of 64 characters to be loaded one after the other so that upper- and lowercase can be programmed.

The character editor program allows you to specify each point of an 8-by-8 mask for each character in the set. One nice feature allows you to build a picture made of more than one character. You can

specify each character in a 3-by-3 grid when creating the special character. After seeing the preliminary version at work, the final version with good documentation should be nice when it's available.

VIC Memory Maps

I've included a few simple memory maps for the new VIC-20. If you look closely, you'll see that the low memory pointers have been changed and the cassette buffer was moved slightly from the PET/CBM design. Commodore is providing extensive information on the VIC, making it much easier to work with. There already is complete documentation (38 pages) available on over 36 user-callable operating system routines. The documentation includes the entry address, parameters expected and what registers are used, and preparatory routines required, error returns, stack requirements, a written description of the routine operation and sample calls. Hopefully this kind of support should help generate some interesting software from outside sources.

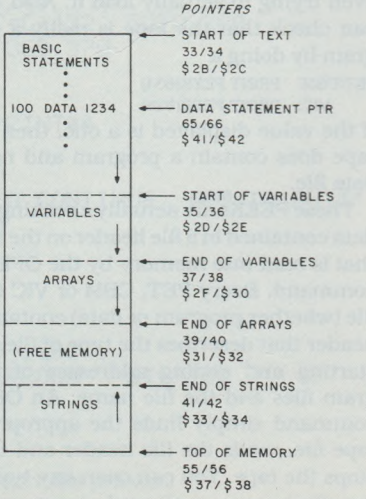
Miscellaneous

I just received sample issues of an interesting magazine from England called *Microcomputer Printout*. It proclaims to be "a plain man's guide to personal computing" and specializes in the PET. The two copies I received were excellent, with 68 pages full of interesting material. The advertisements were rather different, since there were a number of items from Europe that I haven't seen here in the states. The style of the magazine is much like that of *Compute*, but is almost entirely aimed at the PET.

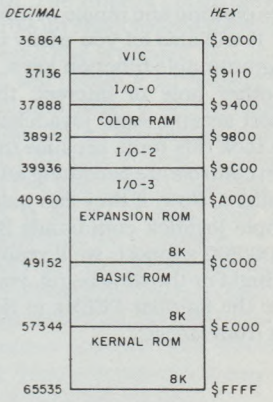
A usual 12-month airmail subscription for us here in the USA is a steep $58. However, the publisher is offering our readers a special half-price deal until Dec. 31 if you mention this column. At $29 for 12 issues, it's a bit more reasonable. Address orders and correspondence to: *Microcomputer Printout*, PO Box 48, Newbury, Berkshire RG16 0BD, England.

The latest *JINSAM Newsletter* tells about NASA's unique applications using 8032 CBM systems and JINSAM 8.0. They are using one system to keep track of recovery equipment and usage of equipment for the Columbia Shuttle. With five emergency landing sites around the world and one set of recovery equipment, it currently takes 17 C-130 transport planes to move everything. Just imagine that a CBM system like yours is keeping track of all those millions of dollars of equipment!

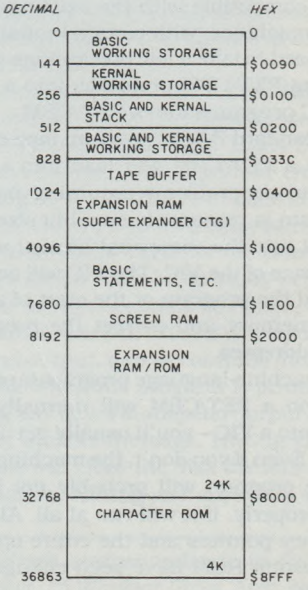
JINSAM 8.0 is also being used by engineers at the Central Instrumentation Facilities to store readings from transducers at Kennedy Space Center, on the Columbia, or at any of ten worldwide tracking locations. JINSAM is used to analyze the information as received and produces reports for maintenance, efficiency ratings, etc. Several other current and future applications were also mentioned in the summer newsletter, making rather interesting reading.□



VIC BASIC storage.



VIC memory map (upper 28K).



VIC memory map (lower 36K).

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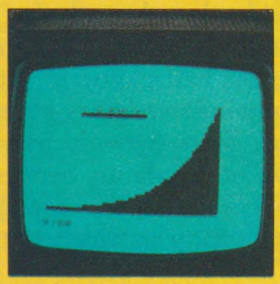

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By Frank J. Derfler, Jr.

Life in the Fast Lane

Modems Designed For Speed

Do you want to set up your own electronic message system? This month, we'll look at an excellent software package that lets you turn your TRS-80 into an electronic message system. I'll also review a nice terminal program for CP/M users. But first, let's talk about going fast and getting rich.

Faster than 300 Baud

A recent discussion in this column on Bell 202 and 212 signalling has resulted in some mail on transmission speed and standards. Some of us have had the pleasant experience of moving up from a 110-baud mechanical printing terminal to a 300-baud device. The difference in performance seems much greater than the 270 percent speed-up shown by the numbers. Moving from 300 baud to 600 or even 1200 baud can make an even greater difference in your enjoyment of electronic message systems and information utilities. It can also reduce your telephone bill!

Most modems in use in the U.S. follow one of three standards established by the Bell system: Bell 103, 202 or 212. Bell 103 signalling is normally limited to a rate of 300 baud. Bell 202 and 212 standards are normally used for higher speeds, but they are very different from each other.

Other manufacturers have developed their own high-speed systems using signalling schemes different from the Bell system standards. The most common is the VA3400 protocol established by Racal-Vadic. This standard is also supported by Anderson Jacobson. Devices called "triple modems," which support Bell 103, Bell 212 and VA3400, are common in professional data communications operations.

Several companies have been able to push the 103 standard modems to speeds over 300 baud. The Potomac Micro-Magic S-100 bus integrated modem has proven its ability to operate reliably at 600 baud. Recent versions of Microperipheral Corporation's Microconnection modems are reported to be reliable at over 300 baud.

Telephone line quality affects the ability of any modem to operate at high speeds. Successful operation at over 300 baud with any 103-type modem should always be considered a bonus. No information utility will run at over 300 baud using the Bell 300 standard, but several message systems (including the AMRAD CBBS) will.

At the higher speeds (1200 baud), there seems to be a difference of opinion in the microcomputer communications community. Several readers have written that they think it is silly for Novation to offer 202-type signalling in their Apple-Cat II when 212 is the standard for interactive communications.

However, several amateur radio operators have been thrilled by Novation's offering because the 202 protocol gives them a 1200-baud system at a low price, and the one-way-at-a-time type of operation used under the 202 scheme is perfect for their kind of transmissions. However, the hams are not in the majority and they will probably want to talk to an information utility using the high-speed 212 protocol too. (Nobody ever wants to go back to 300 baud after he has used 1200.)

Getting Rich

There is a very large market waiting for a less expensive 1200-baud type 212 modem. Who will be the first to introduce one? Get busy and get rich! While I am on the subject of getting rich, the first person out with a simple plug-in parallel printer port for the Osborne I is sure to make a tidy sum. The opportunities to make a buck today are endless.

European Standards

I mentioned some European message systems a few months ago and I've had some inquiries about the signalling standards used in Europe. The International Committee on Telephone and Telegraph (CCITT) has stated its V.21 protocol this way:

300 baud	Channel 1:	binary 1 (mark) 980 Hz
		binary 0 (space) 1180 Hz
	Channel 2:	binary 1 (mark) 1650 Hz
		binary 0 (space) 1850 Hz

If you are determined to work the European systems, you will need a modem which operates on these frequencies. A European option is available on the Microconnection devices, and Novation has a European version of its popular CAT modem.

Call-Waiting

A recent circular from the local telephone company reminded me of a problem that many of you might be paying for in more ways than one. Do you get frustrated by mysterious interruptions in your data communications sessions? Many telephone customers have taken an option called Call-Waiting which gives a short beep on your phone line if the phone is in use when a call comes in. The second party gets a noisy crackle when the first party gets the beep. The crackle and the beep are quite enough to convince either modem that the other has quit, and a disconnect results.

Call-Waiting and data communications don't mix. If you have it and get mysteriously dumped in the middle of a session, you know why. Incidentally, the information utilities keep billing you for a number of minutes if you just disappear without signing off. So if competition for the telephone line is a problem, a separate telephone line might be a better option than Call-Waiting for the data communicator.

With the Information Utilities

I inspected CompuServe and The Source closely last month, but I have two quick comments: The new management at The Source has been on-board about six months now, so watch for changes. More

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- Fully error-checked file transfers using 16 bit CRC protocol. Protocol transfers allow exchanging files which are larger than the system's memory.
- Built in "DIR" command.
- Data capture allows saving received data onto your disk.
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DEALER INQUIRIES WELCOME.

features and a friendlier operating format should be coming up. Meanwhile, CompuServe is still moving at a steady pace. Its Microcomputer Advisory Service, presented by Battery Lane, is a nicely done interactive service which answers some tough questions for novice and pro microcomputer users. This dialogue is a very appropriate use of the medium.

A TRS-80 Message System

Many microcomputer users would like to operate their systems remotely. Integrated modems like the Hayes Microcomputer Systems Micromodem have this capability built in, but TRS-80 users have been left behind. Now, Lance Micklus has come up with a program which tucks itself away in the high memory of the TRS-80 and lets you operate the system remotely through the RS-232C port. This software also prepares an auto-answer modem to answer the phone and orders it to hang up when the user signs off.

Micklus calls the program ST80-X10, and it is available in both cassette and disk versions. The same program will work with the TRS-80 Model I or III. After loading, the program will build a host subroutine in high memory, memory protect and initialize itself and return to DOS or BASIC. The computer then interacts with both the keyboard and RS-232C port. The program is simple and effective.

ST80-X10 can be even more useful when it is run with the separate Communications Center (ST80-CC) software package. This BASIC program turns an ST80-X10-equipped TRS-80 into an electronic message system. The TRS-80 must have at least 48K and two disk drives to carry an effective number of messages. This configuration will allow about 25 to 50 messages to be kept on-line—depending on how many lines you allow each message to have.

The Communications Center package operates in two modes. In the more common mode, the entire system—program and all messages—is held in RAM. The program is self-maintaining in that it will write over the least significant information first when RAM space devoted to messages is full.

The program can differentiate between four levels of users: guest, member, owner and operator. Each kind of user has a different level of privileges. The name of the user and the level of privilege assigned determine what messages a user can see.

A unique "personal only" option makes all messages not addressed to the individual invisible. This, in effect, provides a personal mailbox service. Options which allow all users to see all messages or only certain messages are available by simple commands.

In its second mode of operation, the program can allow the user access to programs stored on the disks. Programs can be run in the host system or uploaded and downloaded between the host and remote user. A password system prevents unauthorized users from writing disk files, and only certain drives are available to normal users. This prevents the system from being crashed by vandals.

ST80-CC comes in a hardcover binder with extensive operating and installation instructions. The program has many options, but they are explained in the documentation along with examples. ST80-X10 has less documentation, but the options it provides are explained clearly.

The message system created by combining ST80-CC and ST80-X10 has particularly good potential as a communications center for clubs, private organizations, schools and businesses. Development and study teams, travelling salespeople, dealers, suppliers and others could put this message system to good use. ST80-X10 costs about $50 and can be used alone for remote operation. ST80-CC also costs about $50, but you need both programs for the complete message system. A cassette version of the message program called ST80-PBB is available for $30. It will run on a 16K TRS-80. The entire ST80 line is available from the Small Business Systems Group.

Crosstalk

Many different kinds of communications programs are available which run under the CP/M operating system from Digital Research. But most have a specific function (driving a modem or transmitting a file) or run only on certain machines (Z-Term for the Apple II with CP/M, for example). None of them brought together all of the smart-terminal features in one package able to run on most CP/M-equipped computers. Crosstalk, from the Microstuf Company, now gives CP/M data communicators smart-terminal features in one user-friendly package.

Crosstalk was originally developed for the North Star Horizon computer, using the Hayes or PMMI integrated S-100 bus modems. The program can now be adapted to run on any CP/M machine with an integral modem or a serial port, but you do have to specify either the integral or serial version when ordering.

The version for use with integral modems is easy to install because these modems always use the same I/O port locations. Serial versions for the Horizon and TRS-80 Model II computers are ready to run. The program can be configured for other computers with serial ports if you know the appropriate I/O locations. Les Freed from Microstuf offers to help his customers by phone or mail with any installation problems.

The Crosstalk program turns a CP/M-equipped computer into a terminal capable of automatically dialing prestored telephone numbers, transmitting CP/M files, saving received data in CP/M files and transferring data files using the same protocol as CLINK and other popular file transfer programs. This feature provides very accurate file transfer, but it must be used with another machine running Crosstalk or a program with the same protocol.

Operation of the program is controlled from a menu which offers four levels of help to the user. Frequent users of the program can quickly get in and out of the menu. New or infrequent users can get all of the help they need to use Crosstalk while they are on-line, ending frantic reference to the manuals.

One feature of Crosstalk should have been done a little differently. When the program is simply transmitting a file (not transferring it with the error-checking feature), it transmits line-by-line, waiting for a carriage return before transmitting the next line.

A speed option can also put a variable-length delay between characters so that distant end systems and carrier systems are not overrun. This combination makes it possible to send prepared electronic mail files to an ABBS, CBBS or to The Source. But some systems, particularly CompuServe's EMAIL, want the transmitting program to respond only to a specific prompt other than a carriage return.

It would be difficult to send a message of over ten lines through EMAIL using Crosstalk. This limitation could be overcome if the prompt recognized by Crosstalk could be easily changed from the menu.

Crosstalk falls into the category of good, hard-working software. It is practical, but not frilly. That description fits CP/M too, so CP/M users should love it. Crosstalk is available for about $150 from the Microstuf Company.

Tell me!

If you have a data communications product that you think could make you rich, let me help. Drop me a line on The Source at TCB967, on CompuServe at 70003,455 or on the AMRAD CBBS at 703-734-1387.□

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Mike Schmidt (EDITOR) 80-US Jan/Feb pg. 94

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By Walter Koetke

Let Your Micro "Strut Its Stuff"

Problems Best Solved By Computer

Do you teach students whose programming abilities far exceed those of everyone else? Are you tired of watching your children write programs to solve problems that are more readily solved with pencil, paper and perhaps a calculator? Here are five problems that might be of interest to you. All are appropriate for secondary school students, and several can be used with mid- and upper-level elementary students. Solutions are likely to require a computer and considerable thought. All could inspire additional questions before a solution is obtained.

1. Let's begin with a briefly stated historical question. Although this problem cannot be described as realistic, the battle account on which it is based is historically accurate. The following unusual fact is known about one of the first recorded battles after the establishment of European colonists in what is now the U.S.

"The product of the year of the battle, the day of the month of the battle, the number of the month of the battle and the average length (to the nearest inch) of the bows found at the battle site is 3486810." Given the additional fact that the battle was fought in the late spring, give the exact date of the battle.

After you calculate the date of the battle, you might be interested in determining who fought the battle, where they fought and why they fought. Although these questions won't involve the computer, finding answers may be tougher and more interesting than determining the date.

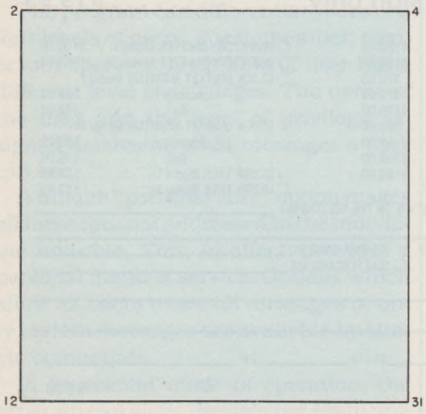


Fig. 1.

2. Draw a square, then choose four positive integers, each less than 100, and write them in any order at the vertices. For example, suppose you choose 2, 4, 12 and 31. You might then draw and label a square as in Fig. 1. Now draw another square inside the first as in Fig. 2. At the vertices of this square, write the absolute value of the difference of the numbers at the two corresponding vertices of the larger square. Repeat this process until you obtain a square whose vertices are all labeled with the same numbers as shown in Fig. 3. Now that this process is well understood, you're ready to address a few questions:

A. Write a program that will permit a user to enter the first four integers to be used when labeling the vertices. The output of the program should then be the numbers to be used as labels on all subsequent squares until the sequence ends with four identical labels.

B. If the first four integers are positive integers less than or equal to 15, which four numbers will generate the largest number of squares before the final square is obtained? In what order must these numbers be placed?

3. As you already know, the set of rational numbers between 0 and 1 is infinite. However, the following table will contain any specific one of these numbers if the table is extended sufficiently.

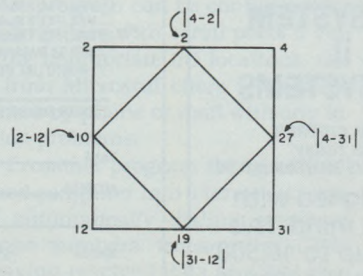


Fig. 2.

1/1
1/2
1/3 2/3
1/4 3/4
1/5 2/5 3/5 4/5
1/6 5/6
1/7 2/7 3/7 4/7 5/7 6/7
1/8 3/8 5/8 7/8
1/9 2/9 4/9 5/9 7/9 8/9
1/10 3/10 7/10 9/10
1/11 2/11 3/11 4/11 5/11 6/11 7/11 8/11 9/11 10/11
1/12 5/12 7/12 11/12

Many interesting questions can be asked about this table of fractions. Several of these questions involve a correspondence between the counting numbers and the fractions in the table. This correspondence is based simply on the order of occurrence within the fraction table. For example, the 1st term is 1/1, the 5th term is 1/4, the 28th term is 8/9, and so forth.

Notice the term number of each term in

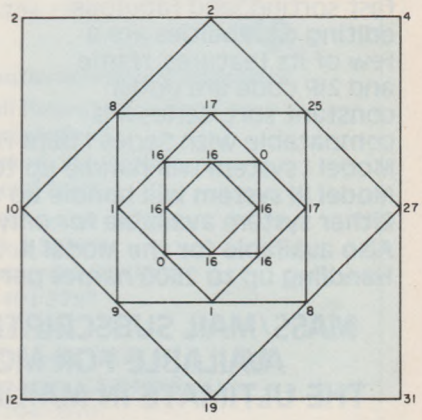
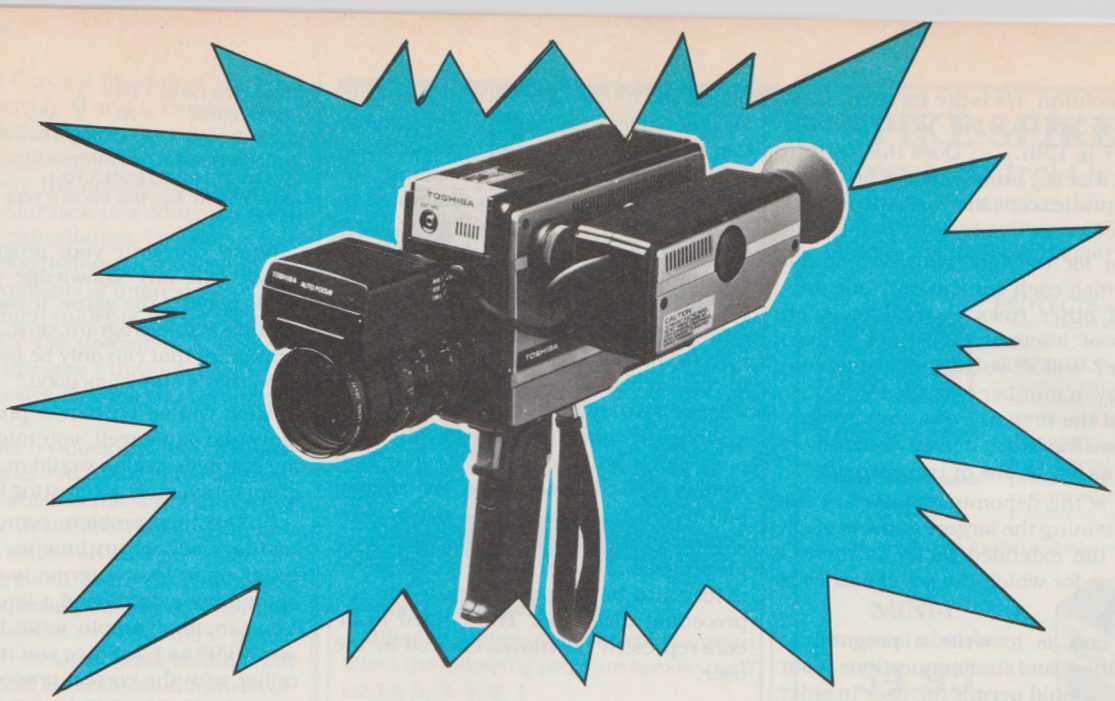


Fig. 3.

Walter Koetke, Putnam/Northern Westchester BOCES, Yorktown Heights, NY 10598.



HOW TO GET THIS $1,400 TOSHIBA AUTO FOCUS CAMERA FREE . . .

VIDEOPLAY magazine wants to publish plans for interesting and practical home video centers which tie together videocassette recorder/players, TV receivers, video games, stereos and what have you. If you've designed and put together such a set-up, submit your plans, pictures and a brief write-up of how it works, and you may win the top prize - a brand new, $1,400 Toshiba color video camera with auto focus.

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First prize will be awarded for the construction article on the most useful, original and economical video set-up. *You must send us plans, a complete list of materials (with prices), photos and clear, step-by-step instructions for the construction of the project.* The second prize of 15 blank videocassettes worth $300 will be awarded to the next best project. The decision of the Contest judges will be final. All descriptive materials become the property of C.S. Tepfer Publishing Co., Inc. and contestants must guarantee that their projects are not copied from a commercial product.

Each entry must include plans, a list of materials and photos and an entry form such as the one below. All entries must be postmarked no later than November 25, 1981. If the contestant is under 18 years of age, the entry must also be signed by a parent or guardian.

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Please enter the enclosed project in your Home Video Center Contest. I have built the unit described and guarantee it is not a copy of a commercial product, nor does it infringe on any patents to my knowledge. I understand that the decision of the judges is final and that my descriptive materials become the property of the C.S. Tepfer Publishing Co., Inc.

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the first column. 1/1 is the 1st term, 1/2 is 2nd, 1/3 is 3rd, 1/4 is 5th, 1/5 is 7th, 1/6 is 11th, 1/7 is 13th, ... Does this pattern indicate that the number of the first term in each row (except the first) will always be prime?

Except for the first two rows of the table, which each contain only one fraction, all other rows contain an even number of fractions. Will this pattern continue? Will all subsequent rows contain an even number of entries?

Five of the first six rows contain only one or two fractions. Will any other rows contain as few as one or two entries?

What is the denominator used in the line containing the largest number of entries in the extended table? Is there a single line for which the set of entries is infinite?

Your task is to write a program to answer these and similar questions. Your program should permit the user to enter the number of a term. The program should then calculate and print the fraction corresponding to that term. For example, if the user enters 8, the fraction 2/5 should be printed. If the user enters 1032, the fraction . . . let your program calculate this one.

An alternative program would permit the user to enter the numerator and denominator of a fraction, and would then calculate and print the number associated with that fraction. If you feel that this or your own alternative program will better answer the suggested questions, write the program you prefer. Efficiency will be important no matter which form you choose to write; your program must complete all computations within a reasonable time.

4. The trapping game is a quickly-learned board game played by two players. The board consists of seven circles connected by line segments representing paths between the circles, as in Fig. 4. The circles are numbered 1 through 7 for easy reference. The first player has one marker which is placed in circle 1. This player can win the game in either of two ways. He wins if he can make any ten moves or if he can move his marker to circle 7. The second player has three markers that are placed in circles 5, 6 and 7. The second player can win only by trapping his opponent's marker. Players alternate moves, the player with the single marker always moving first. A player can move his marker from the circle it occupies to any adjacent vacant circle. This movement must be made along one of the segments connecting the circles. A sample game is illustrated in Fig. 5.

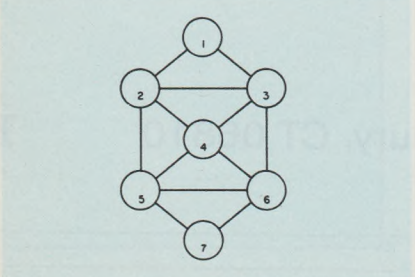


Fig. 4.

Play the trapping game with a friend. You can draw the board and use almost any objects as markers. Be sure you try both the first and the second player's role. Don't proceed with this problem until you have played several games and developed a strategy for winning.

Write a program that will play the trapping game with a user. The program should make the computer the second player and the user the first player. The following output was printed from a sample program. Notice that the game played is identical to the one illustrated in the preceding diagrams. The circled numbers represent the moves entered by the user.

```
RUN

YOU SHOULD READ THE GAME RULES BEFORE
STARTING

YOU MOVE FROM 1 TO ? 3
I MOVE FROM 5 TO 4

YOU MOVE FROM 3 TO ? 1
I MOVE FROM 7 TO 5

YOU MOVE FROM 1 TO ? 3
I MOVE FROM 5 TO 2. AND YOU'RE IN
                    TROUBLE!

YOU MUST MOVE FROM 3 TO 1
AND I WIN BY MOVING FROM 6 TO 3
```

When you write your program, try to incorporate any knowledge you gained while playing the game. If you can write an unbeatable program, do it. If you write a program that can only be beaten in one way, that's almost as good.

After you've written a program that plays the game well, you might try adding graphics, which would make the program much more interesting for the user.

5. Our final problem comes from elementary school arithmetic. Expressing fractions in lowest terms is a habit you should have developed a long time ago. You can, for example, write 16/64 as 1/4 and 49/98 as 1/2. Since you're already familiar with the correct procedure for expressing fractions in lowest terms, let's now consider an incorrect procedure.

The fraction 16/64 might be reduced to 1/4 by just deleting the 6s from numerator and denominator. 16/64 = 1/4. Similarly, 49/98 = 4/8 = 1/2 might be reduced by deleting the 9's from numerator and denominator. Have we discovered a new

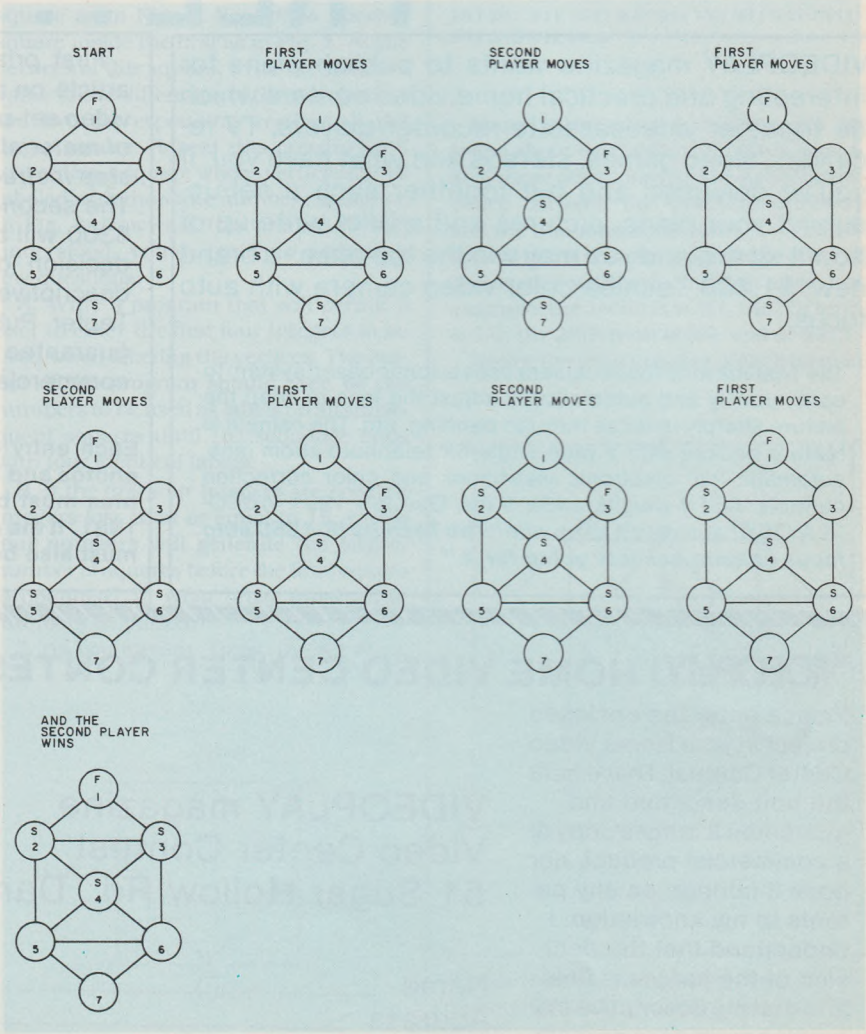


Fig. 5.

technique? Given a fraction of the form AB/BC, where A, B and C can be any of the digits 1 through 9, does A/C always represent a reduced form of that fraction? Unfortunately the answer to both questions is no. Our new procedure, let's call it "careless cancellation," is not generally valid. Nevertheless, you will find the following problems of interest.

A. For which values of A, B and C does AB/BC = A/C? The domain of A, B and C is the set of integers 1 through 9 with the additional restriction that no two values are equal.

B. For which values of A, B, C, D and E does ABC/BDE = AC/DE? The domain of the five variables is the set of integers 1 through 9 with the additional restriction that no two values are equal.

If you've created or stumbled upon any problems especially appropriate for students with access to computers, please let me know. Next month's column will be similar, and an occasional future column might focus on reader-contributed problems if that appears to be of interest.

As you tackle these problems or suggest them to a student, remember that the computer is only one of the tools to be used in obtaining a solution. As with many tools, it can support but not replace thinking. If you create a particularly clever solution, I'd like to see it.□

MICRO QUIZ

Analysis of Algorithms

What sequence of numbers is output when the following program is executed?

```
DATA 5, 3, 4, 2, 1
FOR I = 1 TO 5
  READ A(I)
NEXT I
DATA 3, 5, 2, 4, 1
FOR J = 1 TO 5
  READ R(J)
NEXT J
FOR K = 1 TO 5
  PRINT R(A(K))
NEXT K
```

Answer on page 222.

↙See List of Advertisers on page 210

Compiled by Eric Maloney

A Sound Idea For the Library

Audio Reinforces Learning

Audiotex—a Sound Idea

The Online Computer Library Center has come up with a novel use for the telephone.

Audio transmission.

That's right. If the Columbus-based computer service and research organization has its way, you'll soon be able to pick up your phone and get sound.

In fact, with a few modifications, you might be able to carry on two-way conversations. With another person, even.

The OCLC's idea isn't as absurd as it may first seem. The audio transmission they're talking about would be combined with existing data transmission technology to provide what the library calls an audio-enhanced videotext system. It would let users of viewdata services—which transmit data over telephone lines through a modem and onto your television screen—retrieve both text and sound from the host database.

For example, an encyclopedia entry on the double-breasted sapsucker would be accompanied by that bird's sound. Or a biography of John F. Kennedy could include a recording of his inaugural speech.

The OCLC has given such a service the name of audiotex, and calls its particular brand of audiotex ViewTel. The hardware used with ViewTel is pretty much standard, with the exception of a slightly modified decoder at the receiving end and an Instavox RA-12 rapid access audio unit at the host system.

The Instavox unit, from Education and Information Systems, Inc., in Champaign, IL, operates much like a floppy-disk system used for data storage, only the disk is 15 inches in diameter. It stores 27 to 44 minutes of audio, depending on the kind of audio required.

The OCLC method is the least-expensive and simplest of several ways to transmit audio and data over the same line. As a result, ViewTel sacrifices simultaneity—the user cannot receive sound and text at the same time. He must therefore switch into an audio mode, and receive the recording while the text is frozen on the screen.

The Instavox RA-12 rapid access audio unit, from Education and Information Systems, Inc., is being used by the OCLC as part of their audiotex system.

Mark Bendig, an OCLC research associate, says that the ViewTel project emerged from a recent OCLC videotext experiment called Channel 2000 (see Micro-Scope, October 1981, p. 28), which was a conventional text-only viewdata service.

"What impressed us was the fact that none of the existing videotext services have made use of the audio capabilities," he says.

Audio transmission, he says, has several other possible uses besides enhanced textual material. For instance, a speech synthesizer could be placed in the decoder, the device which translates the videotext signal from the telephone to the television. This synthesizer could have a fixed vocabulary, or could generate phonemes to create words. Voice messages, special codes and the like could be controlled either locally or by the remote computer.

But, says Bendig, the largest application—"and perhaps the most exalted of all"—is two-way audiotex. Here, the user could actually talk with a microphone to a mediator at the host system. The user would describe what information he was looking for, and the mediator would connect the customer to the computer's appropriate database.

At first glance, this may seem like a step backward. Videotext services presumably eliminate human intermediaries, and put the consumer in direct contact with the computer. But Bendig points out that database users traditionally have fairly sophisticated skills, skills which the average consumer generally doesn't have.

"We take a sophisticated service and hand it to a naive user at home," he says. "We impose a rigid kind of access constraint—the menu tree. This is okay for a limited number of sources, but you run into a problem with a vast database. Can you imagine using a menu tree to sift through the contents of an entire database?

"So what we propose to do is in effect take the existing kind of videotext system and replace part of it with humans. It has a human being explicitly as part of the system to make meaningful to the average user the idea of using a computer."

Bendig says that the decoder will be able to answer the telephone and record a message. Thus, a librarian, for example, could take a request for information and respond while the user is not around.

Bendig acknowledges that ViewTel has several potential problems. First, the audio portion of an audio-enhanced database would have to be developed from scratch. "You would have to make your own; there aren't any yet," he says.

Second, the quality of the sound could be less than optimal. The signal has to go through the telephone lines, the decoder, the modulator, the TV circuitry and the amplifier before it even reaches the speaker. And, as Bendig points out, television speakers are not designed for high-fidelity sound.

"But voice transmission will come out okay," he says. "I suspect it will be better than you get in a normal phone conversation."

The OCLC has prepared a prototype of the system, using a North Star microcomputer as the host. Bendig says that the Center has no plans to start up a ViewTel service of its own, but hopes instead to provide it to other videotext services. And he thinks that the interest will be there.

"One sound is worth 32 by 16 characters," he concludes.

—Eric Maloney

An Apple a Day . . .

It is an accepted fact that doctors no longer make house calls, probably because they don't need to. But they sure do make telephone calls.

Take, for example, the doctors in residence at the Ventura, CA, General Hospital. They sometimes make as many as 200 calls a day from the hospital to the neighboring clinic. Even Alexander G. Bell would have cringed at the sight of the jammed switchboard and harried medical secretaries trying to untangle the confusion. Enter the Apple II computer.

The 32 doctors in residence at General Hospital have a variety of patients in the hospital, and others who make regular visits to the out-patient clinic. Each doctor is required to make his rounds and be on call during certain hours of the day in the hospital. In addition, each doctor may see several patients in the clinic during the course of a day. It is something of a problem for a busy physician to remember the schedules for his clinic and hospital activities.

Hence, the clinic, in the pre-Apple era, was often deluged with telephone calls from doctors wondering about their out-patient schedule. It also was difficult for the clinic staff to update the residents on patient cancellations, no-shows and late arrivals.

General Hospital is a modern, well-equipped facility using an in-house closed-circuit television system to display information for staff and visitors. This system was ideal for the display of the out-patient schedules that could keep doctors posted on happenings in the clinic. The hospital technical staff decided that a microcomputer would be the ideal storage device for this information. The hookup to the existing closed-circuit system would be a simple interface.

The hospital selected an Apple computer because of its low cost and flexibility. The software for the system was designed to permit a display of the out-patient schedule at least an hour in advance. The display was designed to allow the doctor to tell at a glance when a patient was scheduled, *and* when the patient arrived. This eliminated dozens of phone calls between the hospital and clinic.

The system provided additional benefits as well. Because they were no longer fielding so many telephone calls, the nurses in the family care center were freed up to perform their regular duties. This resulted in greater efficiency in clinic operations. The residents used their time more efficiently as well, budgeting their hospital hours more carefully, secure in the knowledge that there was no doubt as to their next clinic appointment. The overall increase in staff efficiency was eventually reflected in an increased patient flow.

The telephone calls between the hospital and the clinic were the most tangible measure of the viability of the system. These calls were monitored for four weeks prior to the installation of the system and for four weeks after its installation. The reduction in calls was dramatic—from 536 to 324, a 40 percent drop. In subsequent weeks, as the staff became more comfortable with the system, the calls decreased still further. A survey of the staff showed overwhelming approval of the system.

The information necessary to run the clinic is still the same as it was before. Communication is still vital to the smooth operation of the clinic. The difference the microcomputer made was simple, but elemental—it got things organized.

G. Michael Vose
***Microcomputing* staff**

Apples on the Reservation

Dr. Clayton Curtis is a former electrical engineer who used to be a mainframe systems programmer. He gave up programming for medicine because he wanted to help people. So what is he doing now for the U.S. Bureau of Indian Affairs Health Service?

"I'm working out of the Office of Research and Development for Health Information Services as a programmer," says Curtis from his office in Tucson, AZ. "One of the projects I'm working on is the development of a database of patient information at our central offices which can be accessed by individual doctors at their clinics using Apple microcomputers, modems and regular telephone lines."

The Indian Health Service in the Southwest comprises several clinics, each with two to four doctors, a nursing staff, pharmacy and rudimentary lab facilities. Each of these clinics serves a particular clientele, but all need to access the records kept on patients by the Service's headquarters. In addition, doctors are frequently required to obtain clinical as well as patient information from the central offices.

Curtis, through a long association with computer technology, is anxious to help his colleagues exploit the potential of the microcomputer. "Microcomputers are useful because they can allow the doctor to control the input of information into the overall database. Doctors are notoriously impatient with their client information systems, whether they happen to be file cabinets full of patient folders or computers. With a microcomputer, the doctor can feel like he is more in control of the information input and retrieval process."

Curtis and his team are trying to develop a system to track a patient's problem list, medications, the clinical details of the problem management strategy, standard diagnostic checks, visit planning and other details. Some Indian tribes are plagued by specific classes of health problems, apparently due to heredity.

For example, Curtis says, "The Papago Tribe has a history of a high incidence of diabetes and gall bladder trouble but little heart disease. The Navajos have a lot of heart disease, related to streptococcus infection, but little diabetes. Treatment strategies for a particular patient or a familial group can be tracked by comput-

er so that the physician can quickly determine what treatments have worked before and which have not."

Curtis asserts that micros today are at the level that minicomputers were at 15 years ago. "The small size and low cost of a microcomputer makes the building of a system such as the one we are working on feasible. Microcomputers that can support high-resolution graphics, voice input, touch-sensitive CRT screens and other innovations will broaden the scope of the applications for these machines in the medical field."

Curtis and his staff are using the MUMPS language in their development system. MUMPS only recently became available for the Apple computers used by the Indian Health Service, but Curtis feels that, for clinical applications, it is an excellent language.

"Some of the things that are complicated to do in BASIC or Pascal are easy to do in MUMPS," he says.

Questions on the systems being developed by Curtis and the Indian Health Service can be addressed to Curtis in care of PO Box 11340, Tucson, AZ 85734.

G. Michael Vose
***Microcomputing* staff**

Net for Special Education

Special education administrators now have their own communications and information network.

The net, called SpecialNet, is sponsored by the National Association of State Directors of Special Education. It offers an electronic mail service and several bulletin boards, for administrators who need to quickly access up-to-date information on special education topics.

A key bulletin board, Litigation, offers information on laws regarding handicapped persons, and provides access to the Education for the Handicapped Law Review (EHLR) in Washington, DC.

Personnel Preparation and Training is a bulletin board devoted to new techniques in training special educators. It also reports important developments in ways to work with the handicapped.

The Federal bulletin board lists new federal laws that affect the handicapped, bills currently in Congress, and information regarding funding.

Other bulletin boards include computer applications, employment opportunities, a consultant resource bank, a conference schedule, new products, new publications, assistive devices, advocacy group information and editorials.

In keeping with SpecialNet's orientation toward rapid access to information, bulletin board entries are kept concise (under 40 lines).

Although the system has just started, it is "moving very rapidly," says spokesman Gary Snodgrass. "We'd like for it to be as broad as possible," he says, reaching across various disciplines such as medicine, rehabilitation and education.

SpecialNet can be used by any ASCII-standard, asynchronous microcomputer. Subscriptions cost $200 a year. Costs for access time vary according to the time of day the system is used: $14 per hour from 7 AM to 6 PM, $7 from 6 to 9 PM on weekends and holidays and $4 from 9 PM to 7 AM.

Lise Markus
***Microcomputing* staff**

The Source's Source

"If you thought The Source was all fun and games, wait till you see how it works for your business," reads a recent ad from Source Telecomputing Corp.

It's understandable that the McLean, VA, electronic information service is making a pitch to the business community. A recent survey of its subscribers shows that over 40 percent subscribe to The Source for business or work, while 50 percent say they will use The Source for business-related reasons during the next 12 months.

The survey, which included 48 percent of The Source's 10,000 subscribers, shows that the information service is attracting a decidedly well-educated and affluent clientele. The typical user is a 37.6-year-old male with a college degree or better, and makes $39,000 a year.

The study shows that while 44 percent of The Source's subscribers a year ago belonged to computer clubs, only 27 percent do so today. Three times as many businessmen and managers are likely to use the service than engineers, scientists, professionals or people in computer-related jobs. Forty-two percent are businessmen or managers, 16 percent are engineers or scientists, 14 percent are in the computer field and 12 percent are professionals.

The most popular services among business professionals include research, electronic mail, business planning and forecasting, news and financial market monitoring, personal portfolio maintenance and home education.

"When computers were made easily accessible to the individual in the mid-1970s, persons employed in the computer field were the first to use them, and they treated them as a hobby," said STC Vice-President A. Martin Clark in a prepared statement. "Now we are seeing a rapid spread of practical interest in the benefits of electronic, computer-based services among business professionals."

Medical Data on Line

An electronic information system for doctors is being developed by the American Medical Association and General Telephone and Electronics.

The system, due to go on-line sometime in mid-1982, will feature an encyclopedic database for use in patient diagnosis and treatment. Doctors will access the database through GTE's Telenet communications system, with either a terminal or a microcomputer.

The exact nature of the information to be provided is not yet known, says AMA spokesman Tom Toftley. They're starting out with drug evaluation information, he says, primarily because the AMA recently published its fourth edition of the hard-copy version, and has the data readily available.

A spokesman from GTE says that the service will be initially marketed to hospitals and clinics. It will then be expanded to include private physicians.

Toftley says that the potential market includes 425,000 doctors, 7000 hospitals and 15,000 group practices.

The two organizations have not yet set a price for the service.

Newspapers to Stay

While the electronic newspaper will play an increasing part in American life, more than 90 percent of newspaper subscribers will continue to buy the paper version of their newspaper, says a recent report from International Resource Development.

The report says that during the 80s, the market for electronic newspaper services will grow to more than $500 million, divided evenly between consumer and business uses. But such services will be used by a relatively small portion of the population.

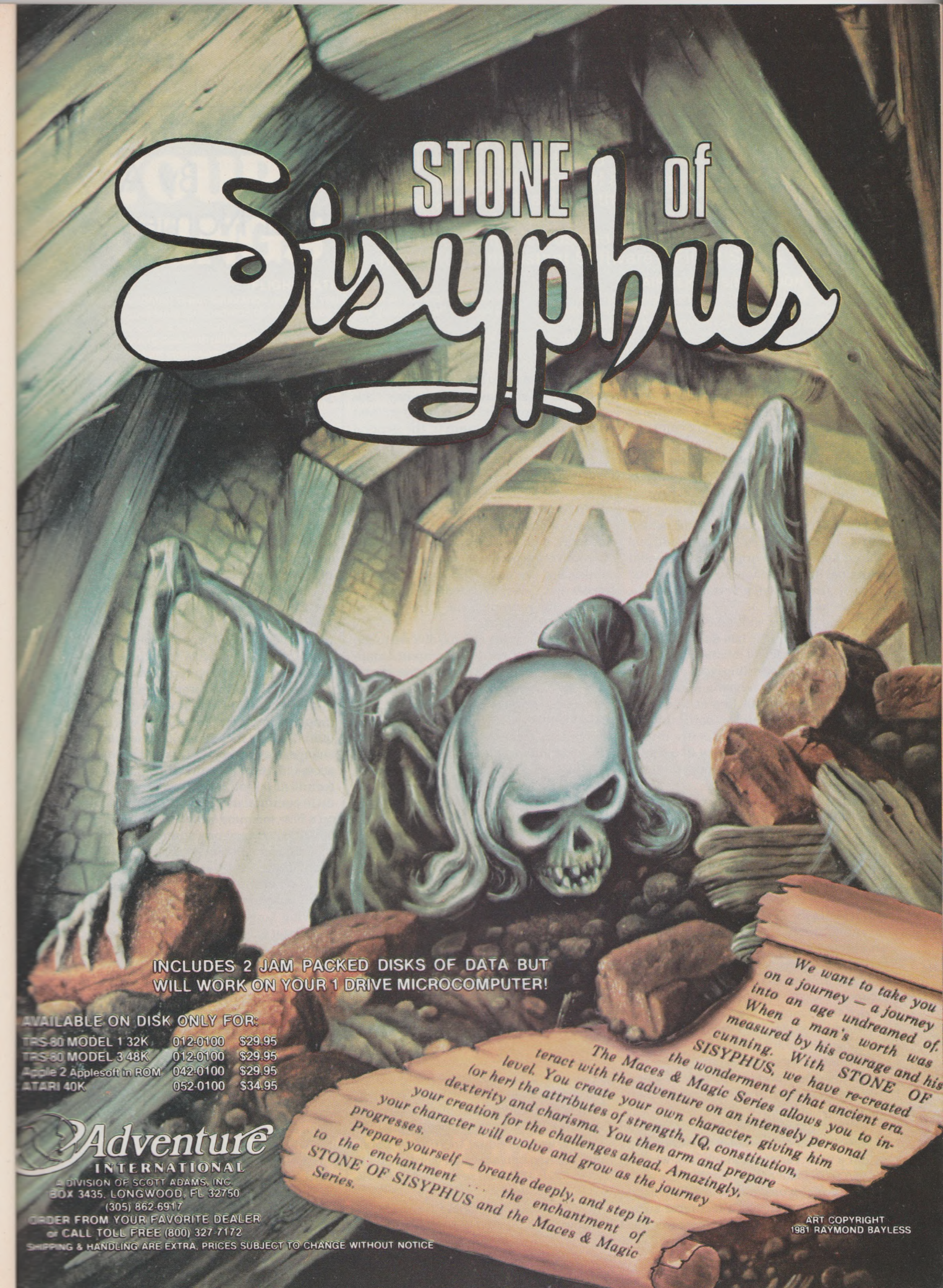
Electronic newspaper services are most likely to provide an enhancement to conventional newspapers, the study says. These services will most benefit those with microcomputers, videotext terminals or specially-adapted FM radios, and include:

- Demand updates, in which a terminal or microcomputer user can get detailed information on stories he or she finds in the paper;
- Broadcast updates, in which the terminal user receives information on topics he has indicated a special interest in; and
- Broadcast updates by FM sideband, in which the user receives news on previously-selected topics through his radio either verbally or on a terminal or printer.

The report says that such products will be most profitable to newspapers with established electronic newsrooms, in which the electronic newspaper is a by-product of an existing system. Newspaper companies will thus most likely dominate the electronic news business, although Ted Turner's Cable Network News or the Westinghouse news network could offer competition.

The report also says that electronic news will foster the development of "boutique" suppliers of news on specialized topics. These suppliers may focus on offbeat news stories, sports and particular hobbies. □

Reader Service for facing page ↙220→



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By Eric Maloney

Micro Monikers

A Micro By Any Other Name . . .

"What is a 'personal computer'?" William Safire asks in a recent *New York Times* column. "Presumably it means that one person can work it, but can't one person work any computer?"

Safire is a little bit off the mark. In the micro world, a "personal" computer is one that can be used *exclusively* by one person (as opposed to a timesharing system, which can be used by one person but is also used by many others), and one whose applications are usually personal (personal finance, home security and the like). It also implies a certain size, cost and ease of use.

But the point is well-taken—the term "personal computer" has its problems.

First, it smacks of Madison Avenue hucksterism. Everything today is personal, from cars to hygiene sprays. If a product isn't personal, it's at least personalized—for example, bath towels, keychains, horoscopes and coffee mugs. A personal computer sounds like something you'd get for $2.95 and a dozen Wheaties box tops.

Second, the term connotes fun, games and frivolity. It conjures up images of Mom, Dad, Buddy, Sis and Spot in the living room playing Space Scum, or Mom in the kitchen cheerfully retrieving a recipe for steamed hot dogs, or (at best) Dad trying to figure out how to avoid having his car reclaimed. A personal computer is not much more than an expensive toy, and certainly not something that a serious businessman would be attracted to.

The term home computer suffers from many of the same problems. Again, it's a device that belongs in the home next to the stereo and the pong game, not in the office, school or laboratory.

So what do we call these things? What name gives an accurate picture of what they can do, both in the home and in business or school?

Microcomputer is the broadest of the generic terms being used. It lumps together a wide variety of machines, which vary in power but are similar in price and size. But microcomputer is an ill-advised marketing term—it has a technical aura that places it in the serious computer or science lab. As Jim Edlin points out in *InfoWorld*, "It still says, plain as day, 'this product is some kind of a computer.' And right now, like it or lump it, the general public is indifferent or hostile to the idea of having computers."

That leaves us with the term desktop. While it accurately describes the average micro/home/personal computer, it perhaps suffers from being identified too strongly with business. Also, as micros become more portable, and as they begin appearing in environments in which desks don't even exist (cars and bus terminals, for example), the term will lose some of its accuracy.

Perhaps the market is too diverse to settle for one term. As microcomputer manufacturers shape their marketing strategies, they're each beginning to focus on a more specific group of consumers. It's possible that, while all are selling microcomputers, some will sell home computers while others will sell desktop computers, just as automobile manufacturers sell luxury, family and compact cars.

One thing's for certain—we've come a long way since the days of the first mainframes. How'd you like to go into your local Radio Shack and ask to see their latest Electronic Numerical Integrator and Computer?

* * * * *

The IBM Personal Computer raised some questions here about the use of the letter K to indicate kilobytes of memory, as in 16K RAM. The problem is that K means one thousand, and thus can mean either one thousand bytes or 1000 words.

This is fine when describing a machine with an eight-bit microprocessor. One word—the number of bits capable of being stored in one location—is eight bits, which happens to be what a byte is. Thus, a byte and a word are the same.

But in a 16-bit microprocessor, such as IBM's, a word is equal to 16 bits. Thus, there are *two* bytes to each word. In such a case, 8K RAM could mean 8K bytes (4K words) or 8K words (16K bytes).

So we've started to use K byte instead of K alone. We hope that this will anticipate potential reader confusion. Microcomputers can be confusing enough as it is.

* * * * *

Another objection to my objection to the word keyboard as a verb, this one from *Northwest Computer News* editor Bob Woodbury (whose excellent article "Beyond Gutenberg" appeared in our May 1981 word processing issue):

"In word processing, creating a file involves a lot of typing (continuous entry of words), but also a lot of inserting, deleting, retrieving, entering and other things not possible on a typewriter. 'Type,' as a verb, does not describe this activity. This verb should only be used to describe a particular phase of word processing. After all, why do we have word processors rather than electronic typewriters?

"Word processors promote a new way of thinking about the process of getting thoughts into print. New words will be required, or the meanings of old words will change. Maybe 'keyboard' will become an accepted verb. It is already a part of the technical jargon, and jargon often ends up in common use. Maybe 'type' will take on a new meaning which includes all the activities of word processing.

"Language purists get stomach trouble when they see or hear nouns used as verbs or vice versa unless this use has been sanctioned by time. I think an evolving language will see a lot of this, and that it is good if the new use does not obscure meaning. The use of 'keyboard' as a verb is clear in meaning."

Well-said. I'll concede that the word keyboard has entered the language as a functional verb (function is, I think, more important than time to the sanctioning of a word). And I'll agree that there is a lot of activity on a computer keyboard not accurately described by the verb type (although a typewriter has similar activity, such as back spacing, setting and clearing tabs, shift-locking and carriage returning, which are covered by the verb type).

But much of the time writers use the word keyboard to describe the entering of straight text. So why not use type? It's shorter, cleaner, and more familiar to noncomputerists.□

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LETTERS TO THE EDITOR

Five Volt Only

We oldtimers in electronics recognize the ±5 volt power supply designation as meaning a positive and a negative power supply, or a total potential difference of 10 volts.

I have used the 6845 mentioned in Joe Martinka's "Videographic" article (Aug. 1981, p. 60), and this chip is a "five volt only" integrated circuit. This minor error will not bother the experienced builder one bit but it may make things more difficult than necessary for the newcomer.

George Young
Tollhouse, CA

Lowercase Mod

The April 1980 issue of *Microcomputing* ("Lowercase for the TRS-80," Steven Wexler, p.132) has a lowercase mod for the Model I. I think this is a great mod and I have been using it since the article appeared and have not had any problems with it. NEWDOS 80's LCDVR works fine with it and so do all the other drivers I have used. That is, until I recently purchased DOSPLUS 3.3D. Its automatic lowercase mod detector does not recognize this mod. So I dug into the code and offer this patch to anyone who may have the same problem: Execute the system's Diskzap program. Display Track F, Sector C. Then find on the fifth line the code 2806. Enter the modify mode and zero these two bytes. That's all. Boot the system and you should have lowercase. This patch effectively bypasses the detector and enables the lowercase driver regardless of the hardware.

Truman Krumholz
Springfield, MO

Less Traumatic for Your Apple

The article in the August 1981 issue of *Microcomputing*, "Apple to Selectric for 83 Cents," looks like a good way to beat the high cost of interface boards.

I found a much less traumatic way to hook everything up. Get a 16-pin DIP socket with long leads such as a wire-wrap type. Trim them about 1/16-inch longer than the leads on your paddle. Next, tack solder small-gauge wire (such as wire-wrap wire) to pins 9 and 16 of the socket. Make neat solder connections very close to the socket base leaving most of the leads free of solder. Make sure there are no shorts. The pins should be straight and filed smooth on the ends. Plug this socket into the game paddle socket. If you have any peripheral cards (I used my disk card in slot 6), the rest is easy. Carefully count the pin slots and trace the printed circuit lands that connect to pins 33 and 50 of the slot connector. At the first solder blob of each land, connect the wires—33 to paddle pin 9, 50 to paddle pin 16. Now you can build and plug in the interface circuit as shown in the article. (I believe the required transistor is npn, not pnp as drawn in the schematic.)

If you have no cards, perhaps you can make a dummy card out of instant stick pc foil and the right sized piece of perf board—or etch you own pc board.

This is a fast method that makes no permanent changes in your Apple. I haven't gotten a Selectric yet, but if I do you can bet I will try this.

Dorrance Rigney
Chelan, WA

In Defense of the IEEE-488 Bus

Mr. Briggs' comments (August 1981) on the appropriateness of the IEEE-488 bus for low-cost microcomputer hardware are somewhat off base. The following manufacturers support the IEEE-488 bus for microcomputers:

- Commodore—computers, disk drives, printers, modems
- SSM—Apple to IEEE-488 interfaces
- California Computer Systems—ditto
- D & W Digital—S-100 to IEEE-488 interface
- Scientific Engineering Laboratories—TRS-80 to IEEE-488 interface
- Basc Two—printers (with RS-232, Centronics, and IEEE-488 interfaces included, not optional)

There are many other manufacturers of devices which support this bus, including Hewlett-Packard (manufacturer of the system Mr. Briggs says is more attractive than the Osborne), Wang, Tektronix, Livermore Data, Fluke and Racal.

While not the most popular communications protocol, the IEEE-488 bus does have broad-based support. The bus supports intelligent devices, spooling (peripheral to peripheral communications without central processor intervention), and multiple devices (up to 15) on a single I/O port. As the computing power of peripheral devices increases, the value of the IEEE-488 bus becomes more apparent; and it is available for the three most popular microcomputer systems in the U.S. at very little cost (in the case of Commodore computers at no extra cost).

P. J. Rovero
San Francisco, CA

I appreciated Mr. Briggs' comments (Letters to the Editor, August 1981) on both Mr. Osborne and the Osborne I, but I must take exception to his comments on the IEEE-488 (GP-IB). Although true that the de facto standard for printer interface has been the Centronics parallel, Mr. Osborne should receive a plus on his score sheet for including the GP-IB in his design. Mr. Briggs is certainly correct in stating that the GP-IB initially got its start through industrial use in instrument control/measurement systems. However, the GP-IB has become a *standard* for peripheral interface (printers, plotters, floppy, hard disk, 9-track tape) with the giants such as HP, Tek and Fluke. DEC and Data General also have GP-IB interfaces for their mainframes. Yes, even Epson and (soon) Zenith offer IEEE-488 interfaces. There are several S-100 to GP-IB cards available (some not very good). In fact, N.H. Research (Irvine, CA) manufactures a dual GP-IB on a single card and has added four dozen verbs to Microsoft BASIC for their product (unfortunately this card is not available without purchasing their system). Cost of the IEEE-488 is set by the marketplace and not necessarily by hardware design. The RS-232 interface is more costly than the GP-IB for the Epson printer and yet the design of the GP-IB is more complicated.

Mr. Briggs needs to reevaluate the GP-IB interface because computers that don't offer GP-IB in the future will suffer in terms of sales.

Robert H. Stratton
Advanced Digital Group Inc.
Garden Grove, CA

The STD Bus Debate

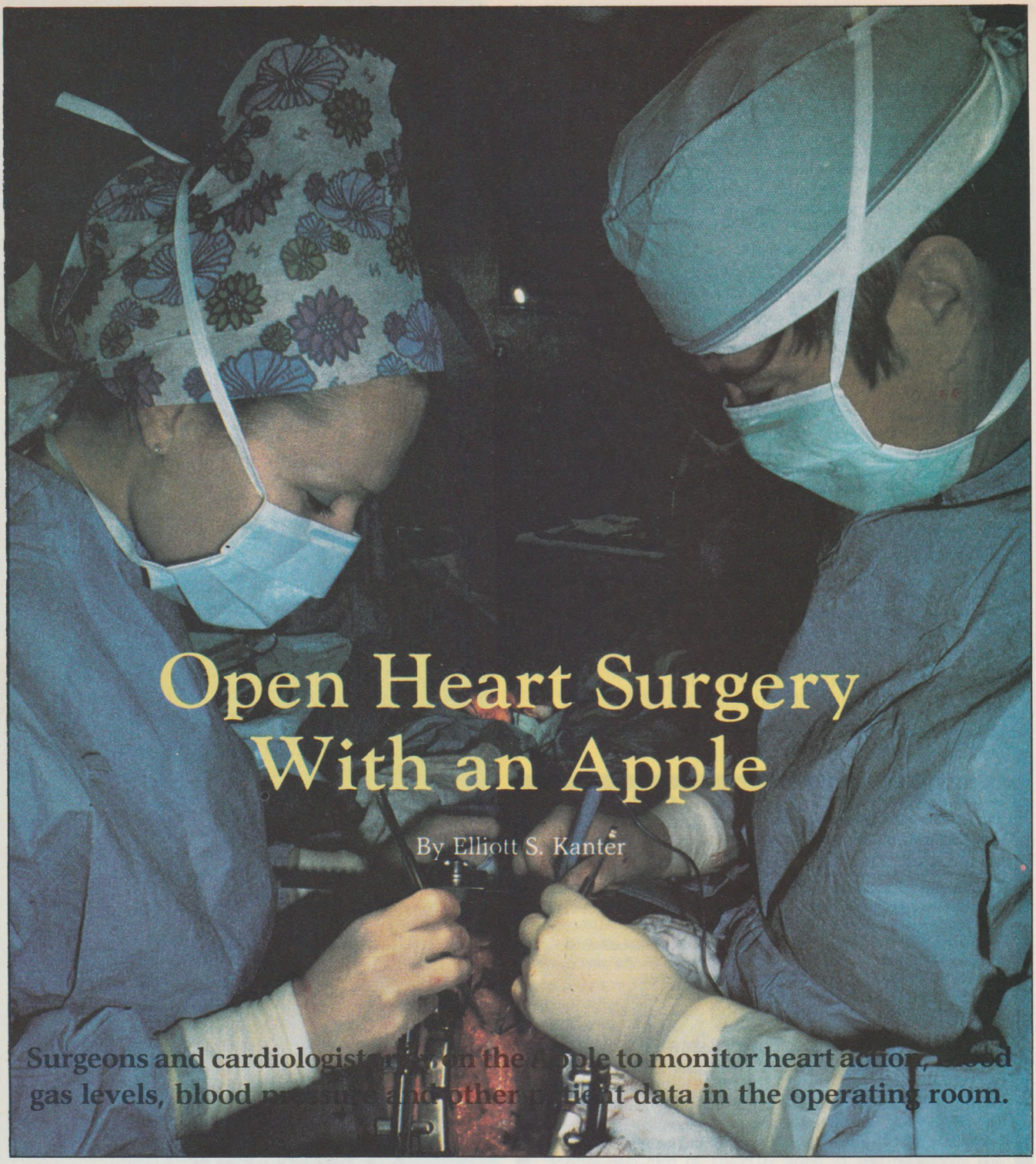
Mr. Langford's article on the STD bus ("The STD Bus is Coming," August 1981, p.226) is generally accurate. There are, however, over 50 manufacturers of STD products and CPU support that include the 8088. The marketplace is very clearly defined as process/control catering to the OEM and not the hobbyist. The target is Intel and the STD is a cost effective alternative to their large boards. The STD will not replace the S-100 (now that there is some standardization) simply because there is a marketplace for the larger sized cards. This marketplace, however, is shifting to the professional side rather than the hobbyist.

I'm very disappointed that one of the major manufacturers, and the *original* designer/user of the STD, was left off the company list. That company is: Pro-Log Corp., 2411 Garden Road, Monterey, CA 93940 (408-372-4593).

Robert H. Stratton
Advanced Digital Group Inc.
Garden Grove, CA

(continued on page 211)

✓See List of Advertisers on page 210



Open Heart Surgery With an Apple

By Elliott S. Kanter

Surgeons and cardiologists rely on the Apple to monitor heart action, blood gas levels, blood pressure and other patient data in the operating room.

Hospitals and computers have been working together for some time. But when Memorial Hospital decided to send an Apple computer into open heart surgery, it represented quite a departure from our conventional procedures.

Memorial is a private, 205-bed hospital in Daytona Beach, FL. For eight years, we've been gradually adding resources that let us diagnose and treat cardiovascular illnesses. This process culminated in 1980 with our approval as a surgical center, the last such center to be certified for the State of Florida.

When I joined the hospital, I became involved in meeting the technological requirements of the surgeon and the cardiologist. Our equipment included a dedicated computer system which, according to its manufacturer, provided a variety of real-time data to the surgeon during surgery. The sorts of information this computer was designed to provide included representations of waveforms (blood pressures, ECG [heart action]), real-time updates of vital blood gas test information and a variety of calculations based on information furnished by the monitors.

The system took data from several sources as diagrammed in Fig. 1, processed it and displayed it on two large

Elliott S. Kanter is the director of biomedical engineering at Memorial Hospital, 875 Sterthaus Ave., Ormond Beach, FL 32074.

CRT displays in the operating room.

Some of the data was immediately and locally obtained from analog and digital outputs to the monitors. But other information was entered by a technician. For example, blood samples were drawn, sent to the remote (some 170 feet distant) cardiopulmonary lab and processed by a computer-enhanced analyzer; the results were then typed into the computer system for display in the operating room. Both locations were able to communicate on a minimum level through the computer via two separate keyboards.

Medical applications of electronics are just like any other: if something can go wrong, it will. In our case, we rapidly learned that our $30,000 computer system was not capable of doing either what the surgeon required or what the manufacturer had promised.

Our problems were further complicated by irregularities in our power supply. Floridians have a nickname for the power company that has to do with the words flicker and flash. The open-heart computer couldn't tolerate these brief episodic flickers, and frequently crashed. Although at no time was a patient's welfare jeopardized, we decided that the system was not reliable enough. We determined to either improve or replace the existing computer system with something that was simple to use, reliable under power fluctuations, cost-effective and able to do other tasks.

Choosing a Micro

We examined our present system, and decided that the channel of information between the cardiopulmonary laboratory and the operating room—

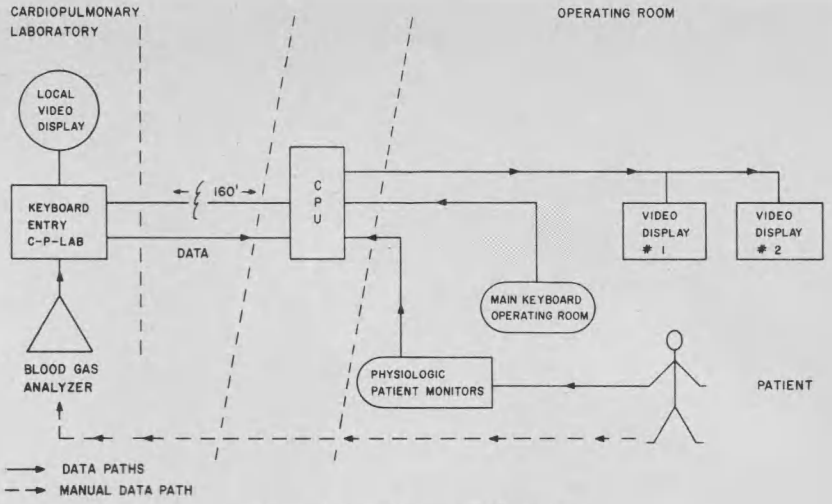


Fig. 1. Original system configuration.

which provided the results of periodic blood tests to determine the concentrations of oxygen, CO_2 and other medically-related parameters—was of primary import. The rest of the information, while nice to have, could be obtained manually nearly as fast, and with less clutter and complexity in an already-complex and cluttered operating room. With the hospital's director of information sciences, we determined that a microcomputer would fill our initial needs, and be able to handle future requirements.

Next we had to pick the equipment and a vendor. The system had to be available off-the-shelf, with support and assistance from the vendor, when we changed from one system to the other. It came down to the Apple and the Radio Shack TRS-80. We learned that no TRS-80s were available, but our local Apple dealer had both systems and system-assistance.

One fact was apparent to us from an administrative, technical and medical viewpoint. The vendor had to offer a complete service, not just a microcomputer in a factory-sealed box. Without a continuing relationship and available support, the microcomputer would soon become more of a hindrance than a help. No software is 100 percent adaptable to all applications. We were lucky: our vendor was able to provide both the product and service.

A number of questions and details remained to be resolved. We set up a meeting between representatives of the hospital administration, bio-medical engineering, the vendor and our perfusionist, Mary Willis. Willis' input and suggestions were particularly important: she operates the heart-lung bypass machine, and needs the data from the blood gas samples. During open-heart surgery, the patient's heart is actually stopped, and clear tubing links Willis' machine with the major blood vessels of the patient's circulatory system; the machine sup-

BLOOD GAS ANALYSIS REPORT: ☐ ARTERIAL ☐ VENOUS

PUNCTURE: TIME A.M. P.M. SITE F_IO_2 % ☐ UNKNOWN

☐ MASK ____ LPM ☐ CMV ____ ☐ T-TUBE ____ ☐ V_T ____

☐ NASAL ____ LPM ☐ PEEP ____ ☐ TOTAL R.R. ____ ☐ SP ____

☐ IMV ____ ☐ MIN. VOL. ____ ☐ M ____

PATIENT STAMP.

PARAMETERS (RANGE)	PATIENT	PARAMETERS (RANGE)	PATIENT
pH (7.40 ± .02)		HCO_3^- (24 ± 2)	
PCO_2 (40 ± 2 TORR)	TORR	TCO_2 (25 ± 2)	
PO_2 (90 ± 10 TORR)	TORR	BE (0 ± 2)	
		S_aO_2 (97%)	

COMMENTS

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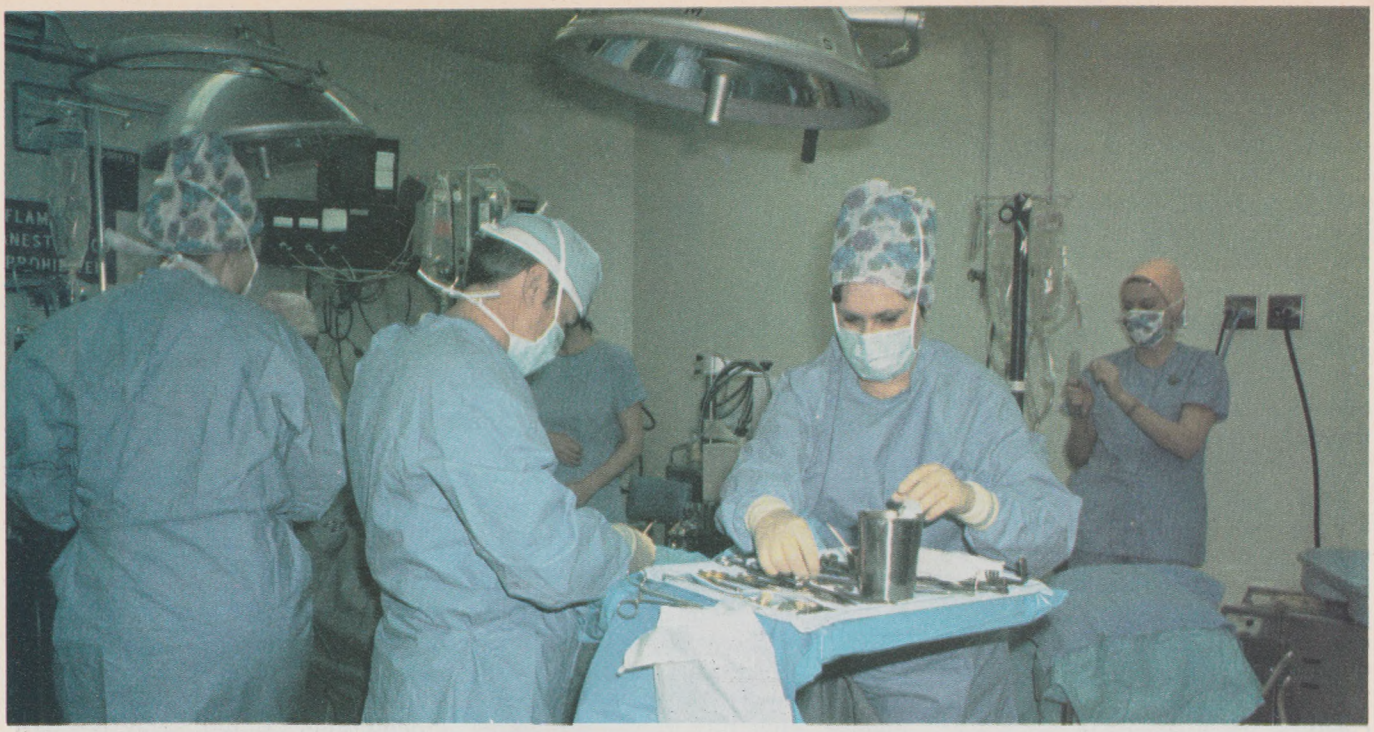
Fig. 2. Blood gas report form.



The surgical team in action in the operating room.

Command	Activity
/CLEAR	Clears screen for new patient
/B	Rings bell
/Jx	Jump cursor to specific location (x) 1 to 4
/C	Clears current area cursor is in
/.	Clears the specific field
/	Back one display
RETURN	Advance to next display

Table 1. Program instructions.

J1	Arterial
J2	Venous
J3	REM (remarks)
J4	Other lab data

Table 2. Screen locations.

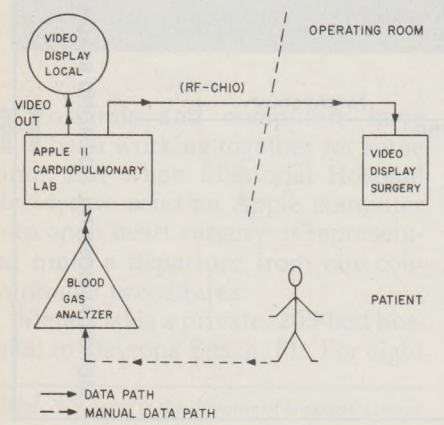
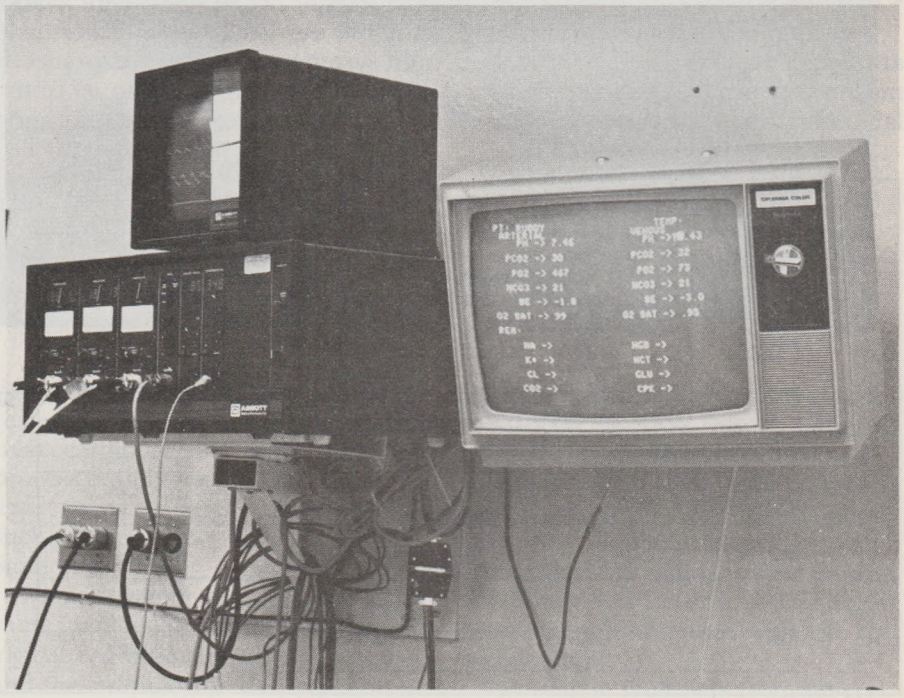


Fig. 3. Apple system configuration.

plies oxygenated blood throughout surgery. Typical pump runs are around two and a half hours, and constant adjustments must be made.

Also present was a member of our cardiopulmonary department to help define the format of the data, the types of data inputs and levels of operator expertise. It was essential that the system be easy to operate, with a minimum of specialized codes or instructions.

Data formatting, or the manner in which data was to be presented, was important. Each of the basic parameters was present in two distinctive tests, the venous and arterial sampling modes. It was critical to be able to immediately tell which was which; a mistake could materially affect the patient undergoing surgery. We experimented with a number of approaches and variations, before settling on a single standard format.



The monitor system and video display in the open heart surgical suite.

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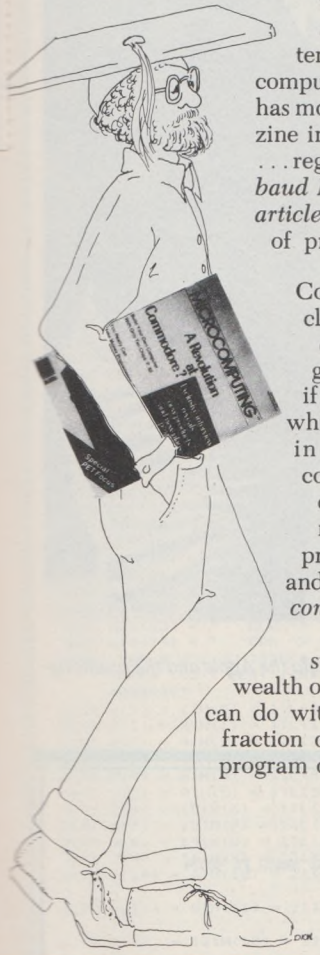

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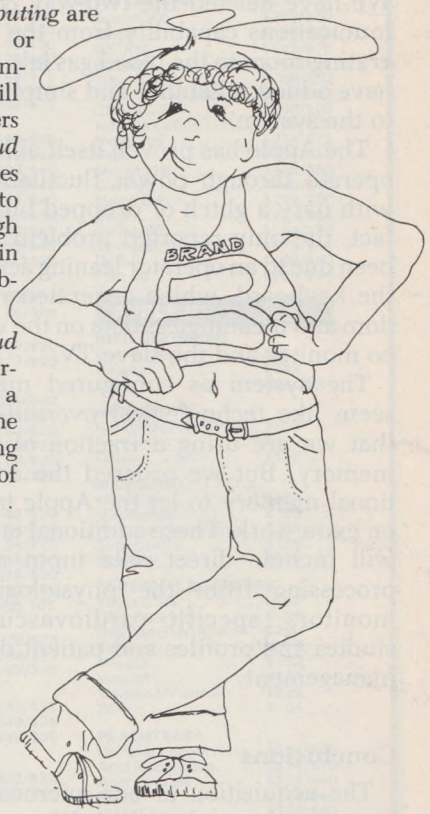

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This format in many ways closely resembles Fig. 2, the standard blood gas analysis report form.

The vendor made several versions of a proposed program, leading to the one that has been used daily since October 1980. The program is loaded into the computer each morning via cassette and updated throughout the case by a cardiopulmonary technologist.

The System

Our system consists of an Apple II with 32K RAM, a nine-inch video monitor and a 19-inch TV in the operating room. The data uses the Apple's ability to support both video and the internal rf modulator operating on VHF channel 10. Fig. 3 details the actual signal paths and configuration. We have deleted the two-way communications capability from the operating room to the blood gas lab, but have added reliability and simplicity to the system.

The Apple has proven itself able to operate through power fluctuations with nary a glitch or dropped bit. In fact, the only reported problem has been due to an operator leaning across the keyboard, which generated random and meaningless data on the video monitor and the slave TV.

The system as configured might seem like technological overkill, in that we are using a fraction of the memory. But we ordered the additional memory to let the Apple take on extra work. These additional tasks will include direct data input and processing from the physiological monitors, specific cardiovascular studies and profiles and patient data management.

Conclusions

The acquisition of our microcomputer was an education. We went from a highly-advertised yet poorly-conceived and executed $30,000 computer system to a simple, reliable and expandable microcomputer system which cost less than $1600. We have found that we can peacefully coexist with a microcomputer system, and Apple has found itself a place on our open-heart surgical team.

I've included the complete program listing so that other hospitals can use the Apple in their own surgical settings. Any questions concerning the program or its operation should include a self-addressed stamped envelope.■

Cardiopulmonary technologist enters the results of a blood gas analysis into the Apple and the results appear both on her monitor and in the operating room.

Program listing.

```
]
]
]    PATIENT DATA SYSTEM FOR APPLE II
]    (C) 1981 MEMORIAL HOSPITAL, 875 STERTHAUS AVE. ORMOND BEACH FL 32074
]
]
]LIST
1  DIM H1$(30),R$(30),V(30),H(30)
     ,L(30)
10 E = 24
20  GOSUB 3000
40  HOME
45  POKE 34,24
100  HOME : FOR L = 0 TO E
110  VTAB V(L): HTAB H(L)
120  PRINT H1$(L);R$(L)
130  NEXT L
1000  REM  CONTROL OF CURSOR BLOC
     K
1001  IF I = 2 THEN I = 4
1002  IF I = 3 THEN I = 1
1010  IF I > E THEN  PRINT "";:I =
     0
1012  IF I < 0 THEN  PRINT "";:I =
     E
1100  VTAB V(I): HTAB (H(I) +  LEN
     (H1$(I)) - 1): INPUT A$
1110  IF A$ = "" THEN I = I + 1: GOTO
     100
1120  IF A$ = "/" THEN I = I - 1:
      GOTO 100
1130  IF A$ = "/CLEAR" THEN  FOR
     C = 1 TO E:R$(C) = "          "
     : NEXT C:I = 0:R$(0) = "
                              ": GOTO
     100
1135  IF A$ = "/." AND I = 16 THEN
     R$(16) = "
```

More →

Program continued.

```
          ":I = I + 1: GOTO 100
1140  IF A$ = "/." THEN R$(I) = "
          ":A$ = "":I = I + 1: GOTO
    100
1150  IF A$ = "/C" THEN  GOTO 200
    0
1160  IF  LEFT$ (A$,2) = "/J" THEN
    GOTO 2500
1210  IF  LEN (A$) > L(I) THEN A$
    = LEFT$ (A$,L(I))
1240 R$(I) = A$:I = I + 1: GOTO 1
    00
2000  IF I < 10 AND I > 3 THEN  FOR
    Q = 4 TO 9:R$(Q) = "          "
    : NEXT Q:I = 4: GOTO 100
2100  IF I < 16 AND I > 9 THEN  FOR
    Q = 10 TO 15:R$(Q) = "
     ": NEXT Q:I = 10: GOTO 100
2200  IF I < 21 AND I > 15 THEN  FOR
    Q = 16 TO 20:R$(Q) = "
     ": NEXT Q:R$(16) = "


          ":I = 16: GOTO 100
2300  IF I > 20 THEN  FOR Q = 21 TO
    E:R$(Q) = "          ":I = 21: GOTO
    100
2400  GOTO 100
2500  IF  MID$ (A$,3,1) = "1" THEN
    I = 4: GOTO 100
2510  IF  MID$ (A$,3,1) = "2" THEN
    I = 10: GOTO 100
2520  IF  MID$ (A$,3,1) = "3" THEN
    I = 16: GOTO 100
2530  IF  MID$ (A$,3,1) = "4" THEN
    I = 21: GOTO 100
2599  GOTO 100
3000  REM  SET SCREEN DYSPLAYS
3010 H1$(0) = "PT --> "
3011 H1$(1) = "TEMP--> "
3012 H1$(2) = "A R T E R I A L"
3013 H1$(3) = "V E N O U S"
3014 H1$(4) = "    PH --> "
3015 H1$(5) = "  PCO2 --> "
3016 H1$(6) = "   PO2 --> "
3017 H1$(7) = "  HCO3 --> "
3018 H1$(8) = "    BE --> "
3019 H1$(9) = "O2 SAT --> "
3020 H1$(10) = "    PH --> "
3021 H1$(11) = "  PCO2 --> "
3022 H1$(12) = "   PO2 --> "
3023 H1$(13) = "  HCO3 --> "
3024 H1$(14) = "    BE --> "
3025 H1$(15) = "O2 SAT --> "
3026 H1$(16) = "REMARKS: "
3027 H1$(17) = "    NA --> "
3028 H1$(18) = "    K+ --> "
3029 H1$(19) = "    CL --> "
3030 H1$(20) = "   CO2 --> "
3031 H1$(21) = "   HGB --> "
3032 H1$(22) = "   HCT --> "
3033 H1$(23) = "   GLU --> "
3034 H1$(24) = "   CPK --> "
3090  FOR Q = 1 TO 10:SP$ = SP$ +
    CHR$ (95): NEXT :ZR$ = "000
    0000000"
3100 V(0) = 1:H(0) = 1:L(0) = 25
3101 V(1) = 2:H(1) = 1:L(1) = 5
3102 V(2) = 4:H(2) = 1:L(2) = 0
3103 V(3) = 4:H(3) = 20:L(3) = 0
3104 V(4) = 6:H(4) = 1:L(4) = 7
3105 V(5) = 8:H(5) = 1:L(5) = 7
3106 V(6) = 10:H(6) = 1:L(6) = 7
3107 V(7) = 12:H(7) = 1:L(7) = 7
3108 V(8) = 14:H(8) = 1:L(8) = 7
3109 V(9) = 16:H(9) = 1:L(9) = 7
3110 V(10) = 6:H(10) = 21:L(10) =
    7
3111 V(11) = 8:H(11) = 21:L(11) =
    7
3112 V(12) = 10:H(12) = 21:L(12) =
    7
3113 V(13) = 12:H(13) = 21:L(13) =
    7
3114 V(14) = 14:H(14) = 21:L(14) =
    7
3115 V(15) = 16:H(15) = 21:L(15) =
    7
3116 V(16) = 18:H(16) = 1:L(16) =
    69
3117 V(17) = 20:H(17) = 1:L(17) =
    7
3118 V(18) = 21:H(18) = 1:L(18) =
    7
3119 V(19) = 22:H(19) = 1:L(19) =
    7
3120 V(20) = 23:H(20) = 1:L(20) =
    7
3121 V(21) = 20:H(21) = 21:L(21) =
    7
3122 V(22) = 21:H(22) = 21:L(22) =
    7
3123 V(23) = 22:H(23) = 21:L(23) =
    7
3124 V(24) = 23:H(24) = 21:L(24) =
    7
3200  FOR Q = 0 TO E:R$(Q) = "
        ": NEXT Q:R$(0) = "
                          "
3499  RETURN
```

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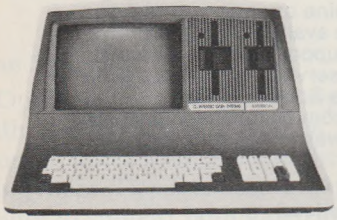

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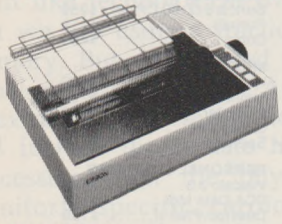

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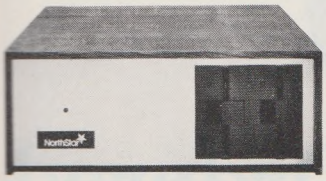

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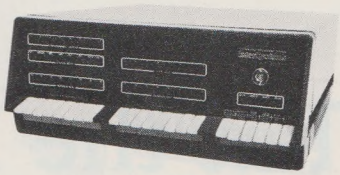

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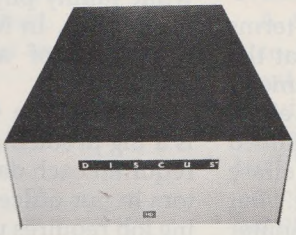

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Just What the Doctor Ordered

By W.J. Blight

Over the past few years, an increasing amount of office overhead has been directly related to staff salaries. Small medical offices have done little to automate, as other businesses have. Our office reached the paperwork overload in 1978. I decided to take the plunge, and leased an Alpha Micro system with four floppy disk drives and an Intertube terminal and Superterm printer.

I didn't start out thinking in terms of micros. I thought at first that the project would be a larger experiment, and that the programming costs alone would reach $45,000. I even applied to the National Health and Welfare office in Ottawa for a grant. But when I realized that a microcomputer might be able to do the job, the project seemed more manageable. So I struck out on my own to investigate the possibilities.

Too Many Cards

Physicians in Canada face several problems unique to this country.

First, Canada has a universal health care system. All bills are paid by the government on behalf of the individual patients. Billing in Manitoba is done to the Manitoba Health Services Commission (MHSC) through an IBM-type claim card, which can be optically scanned for information. This card must be filled out by the office staff and signed by the doctor for each patient visit to the office. These cards are then sent periodically to the Commission for payment, and payment to the doctors is made every two weeks, usually about four weeks after the patient's visit.

Doctors can bill patients privately, but must do so for all patients. A few specialists have opted out of the plan, while family physicians have stayed in the plan. In Manitoba only about 6 percent of all physicians have opted out.

Handling the Commission's cards is a big problem. About 60 cards are required each day from the two doctors in our office. This time-consuming job requires us to type repetitious demographic data on each card—patient's name, address, month and year of birth, etc. Frequent mistakes are made, usually by not recording the day of the visit or by typing a mistake in the date or the patient's health services number.

Another problem is with the ratification of the cards submitted. Some 450 to 500 cards are sent to the commission for each two-week period. When done manually, cards are provided in duplicate, the duplicate card being kept for ratification. They tend to be stored in the order in which the patients came in the office, but the listing of payments as returned by the MHSC comes for each doctor with the patients listed in alphabetical order.

Preliminaries

My practice has been located in a suburb of Winnipeg since 1962. I started as a solo practitioner, and later entered into a two-doctor partnership.

The clinic area is composed of five examination rooms, a small laboratory, general office and waiting room. The staff consists of a registered technologist and a licensed practical nurse. The LPN does the office work, along with such patient care as giving shots, putting on dressings and giving ultra sound treatments. The technologist spends about 75 percent of her time doing laboratory work, and the rest with general duties.

We also employed a typist and general office assistant, who worked about ten hours a week.

We see from 50 to 70 patients a day.

When I decided that automation would be an interesting and useful project, I felt that much programming would be needed to do patients' medical histories.

I applied to the NHW for a grant, but was turned down. Then I realized

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that microcomputers might be an answer, in which case I could start on my own.

I approached the Manitoba Health Services Commission, the paying agency in the province, to find out what criteria would have to be met if I implemented such an automated system. They were adamant that the present claim cards would have to be used. But they were willing to provide cards which could be handled by a printer automatically. Also, they would accept a computer signature on the cards.

We looked at two systems to provide printing. The first system, by IBM or Xerox, used a magnetic card typewriter. But we estimated that on a three-year basis, the cards would cost twice what a typewriter would. This led us to consider a microcomputer. A Byte Shop opened in Winnipeg, and I began to visit it, talking with them about the equipment they handled, and the capabilities of the machines being marketed.

First I had to know what information I needed to store on each patient. The minimum was the amount necessary to fill out the MHSC claim card. I also wanted the middle name and the home and work phone numbers, and the first name of the head of the household. To access each record quickly, we would use a clinic number, to be given to each patient as their files were entered.

The data saved on each patient at this time was:

Last name
First name
Second name
First name of head of household
Address
City
Province
Postal code
Day, month and year of birth
Sex
Marital status
Home phone number
Office phone number
Manitoba Health Services number
Clinic number

We required 120 bytes per patient to store this amount of information. We needed enough storage space for 2500 patients per doctor per year, and space for new patients.

Machines using tape as the main storage were too slow. Floppy disks were starting to appear, and my impression was that an eight-inch disk would store about 2000 patients; four drives would be enough for several years. However, I knew that I would eventually have to use a hard disk.

A further consideration was service. No matter how sound the equipment, it would sooner or later require servicing. Many American-made computers would have to be sent back to the States through customs, which for all practical purposes was out of the question. We thus needed a Canadian dealer, preferably in Winnipeg, with local repair possible.

Initially only two systems looked at all possible: the Heath H11, which is based on DEC (Digital Equipment Corporation) equipment, and an Ohio Scientific. The Heath appeared to be adequate, but there were no floppy drives available, let alone hard disk.

Ohio Scientific took five months to send their material; this led me to conclude that they and their Canadian distributor would be unacceptable to deal with.

Enter Alpha

In the interval, a few journals made

references to a company called Alpha Micro. I wrote them, and they put me in touch with a person who had just started to establish an Alpha dealership in Winnipeg. A demonstration of the machine and its capabilities followed, and I decided to buy it.

In mid-December of 1978 I received the first parts of the system and started learning the BASIC language. I decided that the best way to learn programming was to write enough of a program to be able to start using the equipment in the office. By Jan. 3, 1979, this initial program, although rudimentary, was working, and the equipment was in the office.

This first program entered the patient data into the file,and printed out the card to the Commission, with at least the patient's demographic data and the date on the card. The first few weeks were hectic, but by the third week the office staff noticed a reduction in the time necessary to print the cards.

Both the laboratory technician and the LPN learned quickly to operate the equipment. The program displayed instructions on the screen and we had few problems. One nice feature of doing the programming yourself is that if a step is not clear to the staff, they soon let you know. The staff soon named the computer FRED, which stands for:

Frankly
Ridiculous
Electronic
Device

In March a new doctor came to work with me, and it became necessary to have cards printed for him. Along with this was needed another day book entry. This was the next addition.

The program displayed instructions on the screen and we had few problems.

With the day book, we realized that if we saved the data on our patients, and then typed them out alphabetically at the end of each pay period, we could quickly ratify the listing of payments as sent out by the Manitoba Health Services Commission.

Presently card preparation took about 20 minutes each morning. This freed our LPN to do other work in the office.

We soon found one other use: letter-writing. A reasonably good text formatting program comes with the computer. The time spent on letters has been cut in half.

Benefits we now enjoy include the virtual elimination of improperly filled out cards from the Manitoba Health Services Commission. Once the initial data is entered, it is always reentered correctly on subsequent visits. The date of visit is automatically entered by the computer, and can never be forgotten.

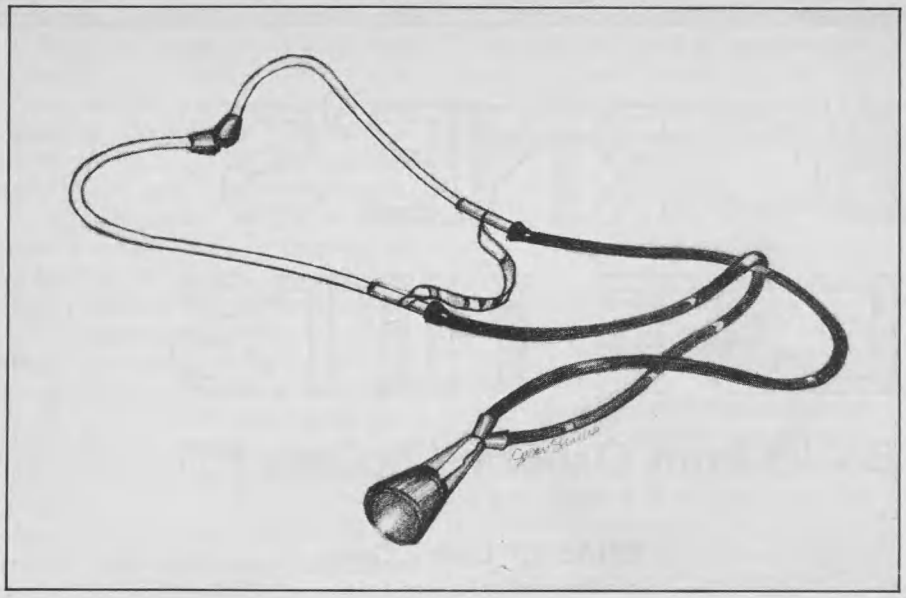
We decided to expand to the hard disk after about nine months. Although the 10 megabyte Hawk drive of Control Data Corporation (CDC) was slightly cheaper, the drugstore in the shopping center was interested in computerizing, so we went with their 90 megabyte Phoenix. Part of the cost was offset by the drugstore's use of the system.

Problems

One of the first changes necessary came from the realization that entering the first name of the head of the household had been a mistake. In trying to build a possible billing system, this piece of information was useless; we needed to enter the clinic number of the head of the household. I therefore changed the program to have the clinic number entered. At the same time, I was able to shorten the number of bytes necessary to hold the information, leaving me with space for additions. I also realized that eventually we would need to purge the files. I incorporated the year that the file had last been accessed. One weekend after these changes were made, the computer read each old record and converted it into the new record.

We also found that the floppy disks were very unreliable. Several boxes of disks could not be used at all, and had to be returned. I found also that I was able to store only about 1200 patients per disk.

Backup was another problem. Be-



cause the floppies were so bad, I felt that I had to have at least two backup copies of each one. Each of the four disks required about five minutes to do each evening. The staff has enjoyed the hard disk for the ease of backing up the records.

The floppies were our only major equipment error. We should have gone for a small hard disk unit right from the start. The down time is slight, with one exception—we suffered a head crash after 13 months of operation.

The system ran for about 14 hours a day until November of 1979. Since that time it has been in use 24 hours a day. Other failures in that time have included three memory chips. Two of these took place within a few months of new boards being first operated, one in a board after two and a half years of operation.

One further deficiency has been in the printers. Superterm printers were bought for both my office and for the drugstore. After about a year, parts started to break. When we tried to obtain parts, we were told that the company was no longer making printers, had discontinued all parts for the ones that they had made, and had apparently no interest in helping to find parts necessary. In one case it took us three months to track down a chip. We've started to convert to Texas Instruments printers, and will try to keep one of the old ones running by using parts from the other one.

Another problem encountered was with the growth of the program. Each addition makes the program longer and more complex. Finally you either run out of internal memory, or you have to start splitting your programs into smaller segments and run them through a menu. Especially when working with floppies, this becomes very frustrating.

I started with a small program to print only the demographic data on the cards. As part of this I had to be able to enter and store all the pertinent information. Now, what happens if there is a typing mistake or the patient moves? You need a change program to change the data in the files. What happens if they move to another city? Make a deletion program. Now comes the request from the staff to have a day book. Okay, write a little program. Dr. X comes to the practice—change the program. Or I need a card for yesterday for this patient—change the program. Wouldn't it be nice to be able to look up the patient's records without knowing the full name, or the clinic number—a generic search program.

The power supply has been a major concern. Microcomputers are sold with the idea that they can run on the regular power supply as provided. Now I realize why there are so many ads in the magazines for power protectors. It becomes very frustrating when you have to press the reset button up to 12 times a day. We've tried to isolate some of these, some with success and some without. It is possible that some are due to other equipment within the shopping center. On investigating the power supply, we also found that all the grounds in the center were tied together. So we isolated the grounds to the computer, which helped considerably. One other answer was to put a choke in the computer to try to maintain the cycles at 60.

Due to our cold weather, interior car warmers are frequently installed, and the cars belonging to employees of the shopping center are plugged in during the day. On the very cold days, we still have a lot of trouble, possibly due to the overuse of these warmers.

One other interesting problem is the vacuum cleaner used in cleaning the office. It has created some rather weird problems; for instance, the computer has tried to call out on the phone line of the modem.

Confidentiality of Records

Much has been written in the past few years on the need for confidentiality of records. Most of the fears of doctors and other persons are for the potential abuse in large systems. If, for example, all patients in Manitoba had their records entered in one computer—for all reasons, including health and governmental agencies—health records might be accessed by people in other areas. Certainly by having many smaller computers scattered through the province, each with only parts of the total information, there is less chance of leakage.

In our computer and most others, password control can be or is built into the system. Each program or file is entered into the storage unit in blocked areas. Access to these areas is through entry of a password. Even within programs, passwords can be built in, so that individuals might be given access to certain parts of the records. Trust must still be placed in the individuals who have the ability to access the records, the same as is given to those with access to the paper records.

Further Development of the System

We've already started to use the computer for our general accounting. In a small office like ours, the programs necessary are very simple. I've written programs to do billing to insurance companies, record payment and do the general ledger. Checks are typed by the computer, with the recording of the check being carried out into the general ledger.

We anticipate that we should be able to put the entire patient record onto the computer, for easy retrieval of data, thus forming an automated record system. This would then allow use of the data in research into disease.

Discussions are currently going on

with the Manitoba Health Services Commission which will lead to trials of sending the information for billing to them over the phone lines, with the payment information in turn being sent to us by phone lines. Verification of claims paid could then be done automatically by the computer.

As we progressed to having the entire card filled out by the computer, we realized that a work sheet was needed. We prepared a two-part work sheet, the second sheet being the prescription pad. One danger of practice in the larger centers is of having prescription pads stolen, and prescriptions forged for drugs. This is no longer possible with our system, since the top of each prescription must be typed by the computer with the name and age of the patient, and the date seen.

At the end of 1979, I felt that it would be interesting to have an age-sex distribution on the patients seen. The program took about 30 minutes to write, and now takes about ten minutes to run at the end of each year.

The acceptance by the office staff has been great, the only question usually being "Why can't Fred. . . ?" The important feature of use of developments in the office such as a computer must be in having the cooperation of the staff, in the planning of the move into the field, and their help in understanding why on occasion, with the introduction of a new program, it will "bomb."

One point must be emphasized—the programs in use now are all ones we developed. We've encountered some delays through programming errors, but these were anticipated by myself and the staff, and have not caused too much frustration. With a major change, we can always fall back on the old program, if the new one doesn't work right.

Conclusion

The use of a microcomputer in a two-doctor office appears to be cost justified, if it is added at a time when the office is considering new staff. In a larger office cost reductions can probably be achieved through the use of the computer and increased efficiency of the present staff.

Although few programs are yet available on the market in this field, more will arrive and the quality will increase. Hardware costs have been dropping at about 20 percent per year; this is likely to continue for some time. However, the cost of the programs is likely to increase as the salaries of the programmers increase.

Many articles on computerization, both in medicine and in general, have been saying that the technology is coming and we should be prepared to look at it. But the technology is here, the programs are available, and now is the time to consider office automation.■

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To stem the tide of rising paperwork, an Apple was installed in this doctor's office and cut down on the time and expense involved in patient care.

Microsystems for the Dental/Medical Office

By E.J. Neiburger

When I began my dentistry practice in 1968, maintaining the office was a simple task. Insurance was not yet common—patients paid cash or made weekly payments. I had one staff member, who helped me at chairside, cleaned instruments, made appointments, wrote out bills (40 a month) and vacuumed the rugs. I practiced dentistry 90 percent of the time with a 70 percent profit/expense margin.

Thirteen years later, my staff is up to seven—most of whom push insurance forms (400 monthly) and billing statements. I practice dentistry 60 percent of the time, reserving the other 40 percent for red tape. My profit/expense margin has dropped to 47 percent.

My situation is not unique in medicine. While new technical developments allow great productivity, paperwork has grown exponentially. A family of four alone can require up to 48 insurance forms (preauthorization and billing forms in triplicate) for one office visit. Keeping track of payments, accounts receivable and unpaid bills takes up an increasing amount of time and expense.

These paperwork problems are aggravated by the fact that fees are often adjusted according to the income level of the patient. Furthermore, payment frequently involves a third party, such as an insurance company or welfare. Keeping track of these factors and educating the patient can be time-consuming and expensive.

Also, taxes and a host of federal, state and local regulations require the doctor to process increasingly more forms. Unemployment insurance, disability, workmen's compensation, payroll taxes—all contribute to mounds of extra paperwork and staff.

Apple II computer with large screen monitor and appointment program.

Most offices are quite efficient using manual methods—photocopy machines, pegboard logs, colored indexes and a reliable staff. But as the practice grows, the doctor must devote more and more time to management. At this point, it's time he consider computerizing his office.

Enter Apple II

After much shopping, we bought an Apple II with 32K bytes of memory. It took up little space and was quiet; it had sound, color, high-resolution graphics and a TV interface, and could be upgraded easily. It was also less expensive than other systems.

Eventually, we upgraded it to 48K bytes of programmable random-access memory (RAM) with one, and later two, disk drives. A year later we added a Corvus 10-megabyte hard disk system. We also switched from a low-resolution TV to a nine-inch, and then a 12-inch, monitor.

When loading times proved inconvenient, we bought several more Apples and dedicated them to different operations. This multiprocessing arrangement gave us minicomputer-like power at a fraction of the usual cost. We paid $13,700, while a comparable mini system—without such features as sound, color, graphics tablet, light pen and A/D board—would have run $50,000. We're now working on multiplexing the system, so that each computer can operate all peripherals independently. (See "Multiprocessor vs. Multitask" by Ken Barbier, June 1981 *Microcomputing*, p. 34.)

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The most important factor for any system is software. Fortunately, we've found some that meets our most critical needs.

The most time-consuming and costly portion of dental practice is handling insurance. We use an insurance form word processor called Dental Insurance Form Writer. It lets us edit and print master insurance forms for each family. As treatment progresses, services and fees are entered and insurance forms printed out on the same day. Lost forms (an epidemic on the increase at insurance companies) are no problem—a duplicate can be loaded from disk and printed with the touch of a key. Preauthorizations can be created and altered as treatment continues, and then printed and mailed.

This program helps reduce the cost of processing insurance forms from $1 (eight minutes of staff time) to 40 cents (three minutes) per form, and allows same-day submittals of forms. This reduces accounts receivable and speeds insurance payments to our patients. Before computers, we processed about 30 forms a day at a cost of $1 a form. We were usually three days behind. Computers reduced costs (after the debugging process) by about 60 percent, thus saving $3100 in labor per year. And mailings are done on the day of service, speeding up payments by one week.

In our credit economy, most patients want to be billed. Our old manual system took two staff members six hours each per month. Much of this time was spent computing interest charges on unpaid accounts. Interest Print, a short billing program, helped reduce billing time to four staff hours; it saves us $2500 per year in salaries and has lowered accounts receivable.

Most offices get along well with a simple appointment book and pencil. Problems occur when the daily appointment load exceeds 30 patients. Constant cancelling, rescheduling, erasing and searching for forgetful patients' appointment times result in delays, errors and over or underbooking. An out-of-control appointment book is a prime source of office stress.

Instead, we use the Appointments program, a user-definable program that converts the Apple into an electronic appointment book. Each patient is given a convenient time slot. Days can be scrolled backward and forward using the arrow keys. There are full editing functions, day sheet and printout modes. The search function allows rapid searches for appointments of forgetful patients.

The program has saved us at least two staff hours per day ($3600 per year), while controlling our appointments and giving us a steady patient load.

The most distressing problem encountered in the doctor's business office is misplaced records. The average dentist has 2000 active and 4000 inactive patients. Since each patient has an ever-increasing file, a tremendous volume of paper accumulates. Records must be pulled and refiled for each treatment and billing transaction. A misplaced file creates delays, lost insurance benefits and postponed treatment.

We use a patient-record program created from a database management program. Each patient record contains the following categories (fields):

- Name
- Address
- Phone
- Medical History
- Amount Owed
- Remarks

A patient's record can be created, edited or deleted. The entire file can be sorted alphabetically or searched by any field. Periodic searches for the field Amount Owed creates a billing or accounts-receivable file. It takes only a moment to retrieve a patient's phone number or print a mailing label or referral list.

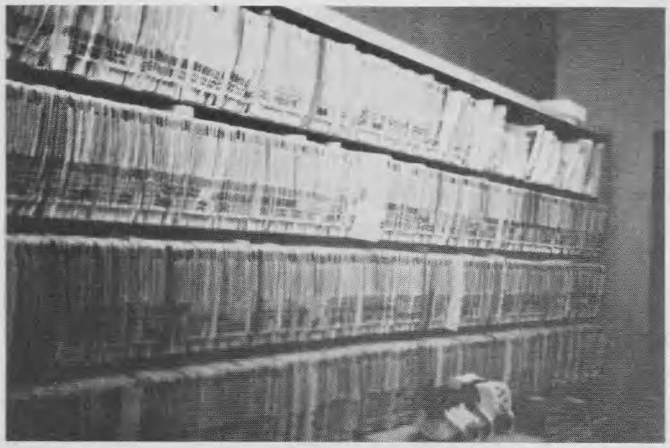
This type of program can also be used with other lists. With a computer we can keep up to date with the 108 insurance carriers that serve our patients. Not only is it easier to educate our patients about their insurance benefits, but they feel they are obtaining the maximum benefits from their dental plans.

About ten years ago prevention became the watchword of dentistry (and medicine). The usual dental checkup is every six months and people tend to forget these long-term appointments. It is expensive and time consuming to search through card files and make up recall post cards.

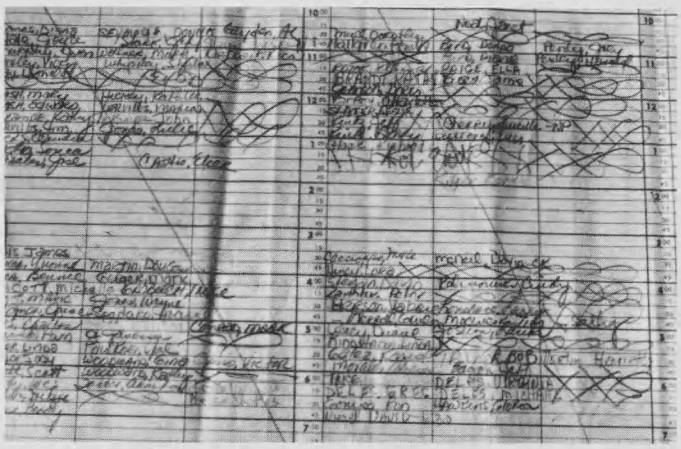
A computerized recall file can be made from a database management program. It will automatically produce recall lists (name, address, phone) for those who are due for an exam and cleaning. Overdue individuals can be reminded of their visit. The recall file contains the fields:

- Name
- Address
- Phone
- Last Visit
- Next Visit
- Remarks

The program will select patients on the basis of the Next-Visit field. When setting up appointments for the next month, the system will sort and print a list of all people who should be seen. Labels are then printed and



Bulky paper patient files.



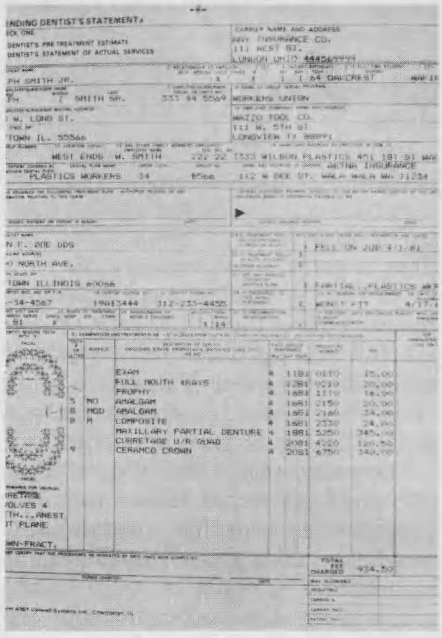
Appointment log—messy, crowded and hard to read.

placed on post cards. This process can save at least one hour of secretary time per day.

One of the first programs I used when I computerized was the word processor, Applewriter. The dental/medical office has ample need for personalized mass mailings. Collection letters, letters thanking individuals for referrals, welcome-to-our-practice letters and treatment instruction/information sheets aid in normal business activities. Reports to insurance companies as well as usual business communication to suppliers, labs and governmental agencies are also needed.

The amount of secretarial time saved and the improved public image created by original rather than photocopied form letters and information sheets make word processing essential for any office.

A program that will print labels is a small investment and a great convenience. With Label Writer, we print several batches of pressure-sensitive labels for each insurance company to which we submit forms. This saves one minute per letter, 40 letters per day. Labels with warning signs (allergy warning, medical alerts, credit status) are placed on the outside of patient records for rapid viewing. These and several other uses of printed labels can save the doctor's and secretary's time.



American Dental Association universal insurance form—almost an industry standard.

Other Computer Uses

- The computer need not lie idle at the end of the day. It can watch the office. The Apple Alarm program uses the Apple II's game paddle ports as inputs for floor mat and window alarms. The computer will register the times and activate alarms or a modem if the office is entered. (We now know what time the janitor works and when other employees arrive or leave the office.) Since several sensors must be triggered to activate the burglar alarm, there are no false alarms.

Patient/appointment records are the most valuable part of any practice. Their destruction by fire or theft can create a financial loss of disastrous proportions. Not only would the doctor lose valuable financial records, but the history of each patient's treatment and diagnostic tests would be compromised. Computers can make rapid backup copies on tape or floppy disk that can be kept off the premises for safety and duplication.

- The most common prescriptions written for dentistry are for antibiotics and pain medications in standard doses. It is helpful to have a small number of preprinted prescription forms for such medicines. Prescription Form Writer is a short program that creates any number of prescription forms. In the past we had a professional printer process several thousand prewritten forms; this was expensive and created a storage problem and theft risk. The program will print several dozen prescription forms on plain paper, when we need them and at a negligible cost.
- Super Checkbook is an excellent program that keeps track of our expenses (checks and deposits). It will keep a log of disbursements and income, and create reports of expenses by user-definable categories. Each month's expenses can be graphed and compared to preceding periods. This program very quickly allows you to see where your expenses are heading.
- Computing payroll for more than three employees takes time. A short payroll program that is upgradable (to new law requirements) and computes federal, state and Social Security taxes is helpful and saves several hours each month.
- There are several medical/dental computer bulletin boards (CBBSes)

by which you can "converse" with colleagues, using a modem and appropriate software. Also, over 300 general computer bulletin boards allow free access for information and advertising. New staff members, programmers and used equipment can often be located by use of CBBSes.

Service networks such as The Source or CompuServe supply a host of news, scientific and investment options for a small fee. Data on weather, news, nutrition analysis, food menus, banking, investments and precious-metal prices can be assessed.

Many insurance companies and suppliers are accepting modem-transferred insurance forms (e.g., Blue Cross). This speeds processing by avoiding the mail and key punching delays of manual forms. Treatment authorizations and billing, computer banking and other financial transactions speed payments and patients' treatment.

- Several programs will allow your computer to interpret lab reports, identify drug interactions and give differential diagnosis and prognosis statistics. The time-consuming calculations that a dentist must make from X-rays in order to plan orthodontic treatment can be quickly done using a graphics tablet.
- Patient education is an important aspect of prevention. Programs that teach the patient can aid the doctor in treatment. Heart Attack Test, Lifeline, Teeth and many other programs educate the patient about potential disease circumstances. The patient can learn about progressive gum disease or decay or how modification of life style affects longevity. Such programs allow the doctor to spend more time with the patients on treatment specifics and individual problems.

Professional education is also enhanced. The Millikin System is a series of 73 tutorial programs on various medical specialties. Encephalon by G. Banks uses graphics to simulate patient reaction during neurological examination. Control Data's new CP/M-based Micro System uses the extensive PLATO system library for general specialty training.

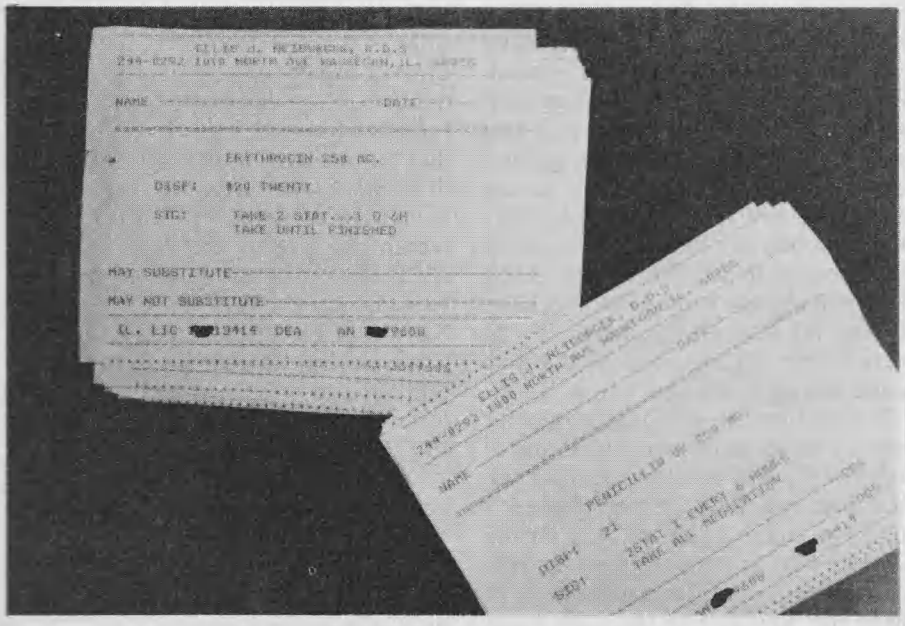
Doctors can learn when convenient, and do this without traveling or closing their offices. Errors in treatment need only influence computer simulations, not actual patients.

Summary

The dental/medical practice has unique problems that can be alleviated by computers. Appointments, insurance, billing, patient records, payroll and the like are becoming serious problems in manually run offices. Since 90 percent of most problems occur in select areas of the practice, a small computer system is ideal.

A microcomputer system allows the partial computerization of operations that the doctor cannot control by manual means. It gives the practitioner more control at less cost in time and money for the patient, the staff and the doctor. ■

Questions concerning the availability of the programs mentioned in this article should be addressed to the author, along with an SASE.



Preprinted prescription forms—a great savings in time.

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This personal finance simulation program, which you can easily convert to your own BASIC, puts you in control of your purse strings.

Focus In on Your Financial Picture

By Jim Shreeve

This simulation program lets you input financial information and predict what's going to happen in the future.

The program is simple, and can be customized to suit your personal or small-business needs. You put the essential facts on a cassette or disk, so they don't have to be reentered every time you run the program. You can adjust your data to fit different options in your present situation, thus giving you a basis for deciding just how much a change will make to your financial picture any number of years down the road.

The program includes the following features:

- It calculates mortgage payments.
- It calculates taxes and insurance for your home.
- It figures value of your home over the coming years.
- It gives a tax break on home payments for your tax bracket.
- It includes the cost-of-living increase over the years.
- It shows income increases each year.
- It weighs cost of living against income.
- It figures income taxes from gross pay.
- It shows take-home pay.
- It makes square footage estimates on new homes.
- It is expandable to cover other variables.

Keep in mind that a simulation program bases its projections on facts only. It cannot take into account a natural catastrophe or a raise in taxes. It is only as reliable as the facts you originally supply it.

This program runs under MSI Extended Disk BASIC. I have used traditional commands, so it should be easy to convert to your own BASIC. The only problem you may have is with a special subroutine to provide screen clearing and cursor placement for my terminal. I have a standard subroutine located at lines 9900 to the end of the program that builds character sets that output the proper control characters to my Heathkit H19 terminal. The H19 uses two-character escape sequences to control it. I merely build these into strings in the subroutine at 9900; then all that's left is to print the strings to the terminal to get the effect wanted.

The screen of your terminal will fill up with data each time you make a correction to the data on the screen. If your terminal is fast or has a small display area (like a 32×16), it is okay as is. If you have a large display like an 80×24 or if you run at a slow speed (below 1200 bits per second), you may want to use the alternate display routine that uses X,Y positioning on the screen to fill in the data.

Here is what happens: in the example of the 80×24 display you have 1920 characters to fill the screen. Since the screen is nearly full of data with the program the way it is, if you are running at 300 bits per second and estimate 1000 characters on the screen, it will take 1000 characters times 10 bits per character, or about 33 seconds, to fill the screen. Each time you change a variable, you have to wait 30 seconds for the screen to refresh before you can verify that you made the right change.

If you use the optional character display setup (and have a terminal to support it), you will have to wait the first time you fill the screen. But each time you make a change, you'll only have to wait an instant while the BASIC program executes a subroutine to place the new data in the right place on the screen. If your computer has cursor positioning built right into the BASIC program, you'll be able to simplify the alternate routine considerably.

Organization of Program

The program is organized into three areas. First is data gathering, which works with the incoming facts file and interacts with the keyboard. Second is data processing, where the facts gathered are used to arrive at such things as total taxes and expenses. Third is the screen display of the data originally entered.

Part of the data-out portion of the program updates the data from the files to contain the information entered by the operator during data gathering. This means that each running of the program will start with the values used in the last running of the program. This is what gives the program its ease of use with so many variables.

Data processing is done in subroutines so that the user can make alterations to suit the special conditions under which the calculations are made. If the tax tables change, it will be simpler to change the tax table subroutine. Also, the local tax table will have to be customized for the area in which you live. If you have to enter AUSTIN for the city in question, you will not have the right tax base for NEW ORLEANS. By using a subroutine, you are able to include any taxes exclusive to your area too. The subroutine eliminates messing with data and read statements.

You may use the tax table information on property taxes as given to get you started, but you'll want to get

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your own local tax tables entered into the program. It is not hard to collect the data: just call a local real estate office, tell them what you're doing and ask for the tax bases and insurance rates. They'll give you a rate per thousand dollars evaluation for local, county and state (if any). Some places will have special education taxes also. You plug those into the subroutine for taxes on property starting at line 9200.

There are some other facts plugged into the program that may be exclusive to your area. One of these is square footage calculations. The factors used in this program are about the national average but they may vary for homes in your area. Again, the local real estate agent can give you the three ranges for square footage of homes in your area. Program lines 8200–8230 contain the square footage subroutines. Note that a low-priced house sells for around $35 per square foot while a high-priced home sells for in the neighborhood of $45 per square foot. Supposedly, the extra $10 per square foot pays for higher-quality fixtures and better workmanship, along with a nicer lot in a so-called better neighborhood. You will learn a lot about real estate values in your area just by customizing this program.

Details of the Program

The program actually consists of two programs: a short one to set up the files with initial values to get the whole thing running and one I've already discussed. Listing 1 is the main program. Listing 2 is the file-building program. Listing 3 is that part of the program to be used when you don't want to wait for the screen to refresh between entries. Remember that Listing 3 requires a terminal capable of accepting cursor position information. Begin by referring to Listing 1.

Data gathering—The listing shown spends its first lines (100–490) setting up the BASIC interpreter for string and line length and describing the program. The REM statements can be left out when they will use up too much memory. Otherwise, remarks provide a built-in refresher for users who will put this program away and then need to remember how to use it in coming months.

From 500 to 550, you're simply getting the files from the disk (or cassette). These are the initial values that will be used to show up on the screen as the program is started. They are the values left over from the last pro-

Listing 1. Main Personal Finance program in MSI Extended Disk BASIC.

```
0100 REM ------------------------------------------------------------------
0110 REM This program is a real life financial condition simulator which
0120 REM can simulate your finances for a selected number of years. The
0130 REM program was written expressly to aid in making decisions per-
0140 REM taining to the purchase of a home. The program is simply adapt-
0150 REM able to the tax and insurance base in your area just by changing
0160 REM a few of the lines of code.
0170 REM
0180 REM The program needn't be changed in some cases because the tax
0190 REM structure for the communities used in this program may be sim-
0200 REM ilar to those in your area.
0210 REM
0220 REM Presently some of the codes are only stored (capital assets and
0230 REM similar things) you may leave these out, but the fact that they
0240 REM are stored on disc may in itself prove handy.
0250 REM Basically the program covers the followins things:
0260 REM * Price of home under consideration
0270 REM * Size of downpayment
0280 REM * Inflation rate
0290 REM * Income
0300 REM * % Average pay raises
0310 REM * Costs of living
0320 REM * Square footage calculations
0330 REM * Appreciation rate of home in %
0340 REM
0350 REM The program inputs are easily changed. Its outputs provide the
0360 REM following information for the number of years specified:
0370 REM * Salary breakdown (take home pay)
0380 REM * House payment (including taxes and insurance)
0390 REM * Deduction of fixed expenses
0400 REM * Appreciated value of house
0410 REM * Tax break value of house
0420 REM
0430 REM ------------------------------------------------------------------
0470 DIGITS= 2
0480 STRING= 80
0490 LINE= 132
0500 OPEN #10 , "GARBAGE" FOR UPDATE
0510 OPEN #20 , "MORGARB" FOR UPDATE
0520 FIELD #10,A=9,B=4,C=4,D=6,F=1,G=2,H=4,J=6,K=5,L=4,M=1,N=9,P=10,W=9
0530 FIELD #20, X4=6,X5=6,X6=6,X7=9,A$=16,C1=4
0540 GET #10
0550 GET #20
0560 GOSUB 9900
0570 LET E=1
0580 PRINT X$(4);E;" SALARY $";A
0610  E=E+1 :PRINT E;" % PAY RAISES ";B
0620  E=E+1 :? E;" TAXED AS ";
0630 IF M=1 THEN PRINT "NOT ";
0640 PRINT "MARRIED"
0650  E=E+1 :PRINT E;" OTHER INCOME PER ANNUM ";W
0655 PRINT
0660  E=E+1 :PRINT E;" INFLATION RATE PER ANNUM ";C
0670  E=E+1 :PRINT E;" PRICE OF FOOD PER MONTH ";X4
0680  E=E+1 :PRINT E;" COST OF UTILITIES PER MO. ";X5
0690  E=E+1 :PRINT E;" CAR EXPENSES INCLUDING PAYMENT PER MO. ";X6
0700  E=E+1 :PRINT E;" ALL OTHER COSTS PER MONTH ";X7
0710 PRINT
0720  E=E+1 :PRINT E;" CASH ASSETS ";N;
0730  E=E+1 :PRINT TAB(40); E;" HARD ASSETS ";P
0740  E=E+1 :PRINT E;" VALUE OF CAR ";K
0750 PRINT
0760  E=E+1 :PRINT E;" PRICE OF HOME ";D;
0770  E=E+1 :PRINT TAB(40);E;" DOWNPAYMENT ";J
0780  E=E+1 :PRINT E;" THE HOME IS ";:IF F=1 THEN PRINT "USED "
0790 IF F=2 THEN PRINT "NEW" :GOTO 800
0795 PRINT
0800  E=E+1 :PRINT E;" MORTGAGE INTEREST RATE ";L;
0810  E=E+1 :PRINT TAB(40);E;" SQ. FT. OR VAL RANGE 1,2,3 ";H
0815 PRINT
0820  E=E+1 :PRINT E;" NUMBER OF YEARS TO REPORT ";G
0822  E=E+1 :PRINT E;" APPRECIATION % ";C1
0825 LET B$="ENTER NUMBER OF SELECTION. ENTER -DONE- TO EXIT ROUTINE"
0830 GOSUB 9800 :? X$(6);TAB(10);
0840 PRINT TAB(10);B$;TAB(45);X$(3);X$(7);
0850 LET X=1:Y=24
0860 GOSUB 9900
0870 PRINT X$(2);"[ ]";
0880 INPUT B$
0885 IF B$="" THEN 850
0890 IF B$="DONE" THEN GOTO 1000
0900 LET E=VAL(B$)
0910 IF E>11 THEN 940
0915 IF E<1 THEN 850
0920 ON E GOSUB 8010,8020,8030,8040,8050,8060,8070,8080,8090,8100,8110
0930 GOTO 560
0940 LET E=E-11
0945 IF E>8 THEN 850
0950 ON E GOSUB 8120,8130,8140,8150,8160,8170,8180,8300
0960 GOTO 560
1000 PRINT "IF TOWN IS ";A$;" HIT RETURN. ELSE ENTER TOWN";
1002 INPUT B$
1003 IF B$="" GOTO 1010
1005 LET A$=B$
1010 REWRITE #20
1015 REWRITE #10
1020 LET U=0
1030 PRINT X$(9);X$(4);
1050 LET S=0
1060 GOSUB 9200
```

More

Listing 1 continued.

```
1070 IF S=0 THEN LET A$="AUSTIN" : GOTO 1050
1075 LET A=A+W
1080 ON M GOSUB 9000,9100
1090 LET R=A*.0613
1100 PRINT X$(4);TAB(35);"DETAILS FOR YEAR ";
1120 PRINT
1130 PRINT "INCOME ";A/12;"  FICA ";R/12;"  FED ICT ";Q/12;
1140 LET X1=A/12-(R+Q)/12 :PRINT "    TOT ";X1
1150 PRINT : PRINT
1160 PRINT "PAYMENT ";T1;"  TAXES & INS ";S;"    TOT ";
1170 LET X2=T1+S :PRINT X2
1175 PRINT
1180 PRINT "ADD IN FOOD ";X4;" AND UTIL ";X5;" AND AUTO ";X6;
1190 PRINT "OTHER ";X7;" TOT ";
1200 LET X8=X4+X5+X6+X7 :PRINT X8
1205 LET D=D+D*(C1/100)
1210 PRINT : PRINT TAB(50);"VAL OF HOUSE ";D
1220 LET X9=X1-(X2+X8)
1230 PRINT "GRAND TOTAL MONTHLY ";X9
1231 LET I=A : LET A=A-(X2*12)
1232 LET Z=Q : ON M GOSUB 9000,9100
1235 LET Q=Z-Q : PRINT "TAX BREAK ";Q : LET Q=Z
1237 LET A=I
1240 PRINT
1245 PRINT "ENTER [BAK] to go back and change parameters"
1250 PRINT "ENTER [NXT] for next years look at stuff"
1260 PRINT "ENTER [STP] to stop program"
1270 INPUT "WHICH ENTRY",B$
1280 IF B$="STP" THEN CLOSE #10:CLOSE#20: END
1290 IF B$="BAK" THEN CLOSE #10:CLOSE #20:GOTO 500
1300 REM DATA UPDATER
1305 LET X2=X2*12
1310 FOR E=1 TO G
1340 LET A=A+A*(R/100)
1350 ON M GOSUB 9000,9100
1360 LET R=.0613*A
1370 LET X1=A-(R+Q)
1390 PRINT "TOTAL INCOME NET ";X1
1400 PRINT "TOTAL ON HOUSE ";X2
1410 LET X8=X8+X8*(C/100)
1420 PRINT "TOTAL EXPENSES ";X8*12
1425 LET X9=X1-(X2+X8*12)
1430 PRINT "TOTAL                    ";X9
1435 GOSUB 1500
1440 NEXT E
1450 STOP
1460 GOTO 1245
1500 LET I=A
1510 LET A=A-X2
1515 LET Z=Q
1520 ON M GOSUB 9000,9100
1530 LET Z=Z-Q
1540 GOSUB 1600
1550 PRINT "TAX BREAK ";Z
1555 PRINT :PRINT
1560 LET A=I
1570 RETURN
1600 LET D=D+D*(C1/100)
1610 PRINT TAB(40);"VALUE OF HOME ";D
1620 RETURN
8000 REM REPAIR SUBROUTINES
8010 INPUT "SALARY ",A
8015 RETURN
8020 INPUT "% PAY RAISES ",B
8025 RETURN
8030 INPUT "1-IF SINGLE  2-MARRIED",M
8035 RETURN
8040 INPUT "OTHER INCOME",W
8045 RETURN
8050 INPUT "INFLATION RATE IN %",C
8055 RETURN
8060 INPUT "FOOD (MONTHLY) $",X4
8065 RETURN
8070 INPUT "UTILITIES (MONTHLY) $",X5
8075 RETURN
8080 INPUT "AUTOMOTIVE COSTS GAS,PAYMENT,ALL (MONTHLY) $",X6
8085 RETURN
8090 INPUT "OTHER MONTHLY LIVING COSTS $",X7
8095 RETURN
8100 INPUT "CASH ASSETS",N
8105 RETURN
8110 INPUT "HARD ASSETS (DEPRECIABLE)",P
8115 RETURN
8120 INPUT "VALUE OF CAR",K
8125 RETURN
8130 INPUT "PRICE OF HOME",D
8135 RETURN
8140 INPUT "DOWNPAYMENT",J
8145 RETURN
8150 INPUT "1-FOR USED  2-FOR NEW",F
8155 RETURN
8160 INPUT "INTEREST RATE %",L
8165 RETURN
8170 INPUT "SQ FT ENTER 0 IF UNKNOWN",H
8172 IF H=0 THEN 8200
8175 RETURN
8180 INPUT "NUMBER OF YEARS FOR REPORT",G
8185 RETURN
8200 INPUT "VALUE RANGE OF HOUSE 1-LOW 2-MED 3-HI",I
8210 IF I=1 THEN H=INT(D/35)
8220 IF I=2 THEN H=INT(D/40)
8230 IF I=3 THEN H=INT(D/45)
```

More

Listing 1 continued.

```
8240 RETURN
8300 INPUT "HOUSE APPRECIATION % ",C1
8310 RETURN
9000 REM SINGLE TAX RATES
9002 LET Q=0
9005 IF A>108300 THEN Q=55697+.7*(A-108300)
9007 IF Q>0 THEN RETURN
9010 IF A>81800 THEN Q=37677+.68*(A-81800)
9011 IF Q>0 THEN RETURN
9015 IF A>55300 THEN Q=20982+.63*(A-55300)
9016 IF Q>0 THEN RETURN
9020 IF A>41500 THEN Q=13392+.55*(A-41500)
9021 IF Q>0 THEN RETURN
9025 IF A>34100 THEN Q=9766+.49*(A-34100)
9026 IF Q>0 THEN RETURN
9030 IF A>28800 THEN Q=7434+.44*(A-28800)
9031 IF Q>0 THEN RETURN
9035 IF A>23500 THEN Q=5367+.39*(A-23500)
9036 IF Q>0 THEN RETURN
9040 IF A>18200 THEN Q=3565+.34*(A-18200)
9041 IF Q>0 THEN RETURN
9045 IF A>15000 THEN Q=2605+.30*(A-15000)
9046 IF Q>0 THEN RETURN
9050 IF A>10800 THEN Q=1555+.24*(A-10800)
9051 IF Q>0 THEN RETURN
9055 IF A>8500  THEN Q=1072+.21*(A-8500)
9056 IF Q>0 THEN RETURN
9060 IF A>6500  THEN Q=692+.19*(A-6500)
9061 IF Q>0 THEN RETURN
9065 IF A>4400  THEN Q=314+.18*(A-4400)
9066 IF Q>0 THEN RETURN
9070 IF A>3400  THEN Q=154+.16*(A-3400)
9071 IF Q>0 THEN RETURN
9075 IF A>2300  THAN Q=.14*(A-2300)
9080 IF A<2300  THEN Q=0
9085 RETURN
9100 REM THIS IS TAX TABLE FOR MARRIED (JOINT)
9101 LET Q=0
9105 IF A>215400 THEN Q=11750+.7*(A-215400)
9106 IF Q>0 THEN RETURN
9110 IF A>162400 THEN Q=81464+.68*(A-162400)
9111 IF Q>0 THEN RETURN
9115 IF A>109400 THEN Q=47544+.64*(A-109400)
9116 IF Q>0 THEN RETURN
9120 IF A>85600  THEN Q=33502+.59*(A-85600)
9121 IF Q>0 THEN RETURN
9125 IF A>60000 THEN Q=19678+.54*(A-60000)
9126 IF Q>0 THEN RETURN
9130 IF A>45800 THEN Q=12720+.49*(A-45800)
9131 IF Q>0 THEN RETURN
9135 IF A>35200 THEN Q=8162+.43*(A-35200)
9136 IF Q>0 THEN RETURN
9140 IF A>29900 THEN Q=6201+.37*(A-29900)
9141 IF Q>0 THEN RETURN
9145 IF A>24600 THEN Q=4505+.32*(A-24600)
9146 IF Q>0 THEN RETURN
9150 IF A>20200 THEN Q=3273+.28*(A-20200)
9151 IF Q>0 THEN RETURN
9155 IF A>16000 THEN Q=2265+.24*(A-16000)
9156 IF Q>0 THEN RETURN
9160 IF A>11900 THEN Q=1404+.21*(A-11900)
9161 IF Q>0 THEN RETURN
9165 IF A>7600  THEN Q=630+.18*(A-7600)
9166 IF Q>0 THEN RETURN
9170 IF A>5500  THEN Q=294+.16*(A-5500)
9171 IF Q>0 THEN RETURN
9175 IF A>3400  THEN Q=.14*(A-3400)
9180 IF A<3400  THEN Q=0
9185 RETURN
9200 REM
9201 IF A$="AUSTIN" THEN S=D*.00094+D*.0006+D*.0003+D*.00034
9205 IF A$="GEORGETOWN" THEN S=D*.00136+D*.00045+D*.0003+D*.00034
9210 IF A$="PFLUGERVILLE" THEN S=D*.00065+D*.00033+D*.0003+D*.00038
9215 IF A$="ROLLINGWOOD" THEN S=D*.00044+D*.0003+D*.00036
9220 IF A$="ROUND ROCK" THEN S=D*.00096+D*.0005+D*.00036+D*.00036
9225 IF A$="WESTLAKE HILLS" THEN S=D*.0016+D*.00021+D*.0003+D*.00011
9230 IF A$="ELGIN" THEN S=D*.0013+D*.00038+D*.00038+D*.00021
9235 IF A$="MANOR" THEN S=D*.00083+D*.00083+D*.00021+D*.00038
9240 IF A$="LEANDER" THEN S=D*.00109+D*.0005+D*.0003+D*.00036
9245 REM CALC P&I MO. PAYMENT WHILE YER HERE
9250  T1=(((1+L/1200)↑360)-1)/((L/1200)*((1+L/1200)↑360))
9252 LET Z1=D :LET D=D-J
9255  T1=D/T1
9260 LET D=Z1
9266 RETURN
9790 STOP
9800 REM ************* ENABLE TO WRITE ON 25 LINE ********************
9805 REM
9810 PRINT X$(1)
9815 PRINT X$(8)
9820 PRINT CHR$(27);CHR$(89);CHR$(56);CHR$(32);
9825 RETURN
9850 REM *********** DISABLE THE 25TH LINE *************************
9855 PRINT X$(9)
9860 RETURN
9890 STOP
9900 REM ************************************************************
9910 REM TERMINAL I/O PACKAGE
9920 REM
9930  X$(1)=CHR$(27)+CHR$(106)          :REM SAVE CURS POSITION
9940  X$(2)=CHR$(27)+CHR$(89)+CHR$(31+Y)+CHR$(31+X):REM SET TO X,Y
9950  X$(3)=CHR$(27)+CHR$(107)           :REM SET TO PREV SAVED
```

More →

Listing 1 continued.

```
9960   X$(4)=CHR$(27)+CHR$(69)                    :REM H/U- ERASE
9970   X$(5)=CHR$(27)+CHR$(75)                    :REM ERASE LINE FM CURSOR
9980   X$(6)=CHR$(27)+CHR$(112)                   :REM REV VIDEO ON
9990   X$(7)=CHR$(27)+CHR$(113)                   :REM REV VIDEO OFF
9991   X$(8)=CHR$(27)+CHR$(120)+CHR$(49)          :REM ENABLE 25TH LINE
9992   X$(9)=CHR$(27)+CHR$(121)+CHR$(49)          :REM DISABLE 25TH LINE
9993   X$(10)=X$(10)                              :REM FOR TEMP STORAGE
9994 RETURN
```

Listing 2. File-building program.

```
0100 REM THIS IS TO CREATE THE ORIGINAL DISKETTE FILES FOR THE SIMULATION
0500 OPEN #10, "GARBAGE" FOR OUTPUT
0510 FIELD #10,A=9,B=4,C=4,D=6,F=1,G=2,H=4,J=6,K=5,L=4,M=1,N=9,P=10,W=9
0520 LET A=20000.00
0530 LET B=8
0540 LET C=10
0550 LET D=60000
0560 PUT #10
0570 CLOSE #10
0580 OPEN #10, "MORGARB" FOR OUTPUT
0590 FIELD #10, X4=6,X5=6,X6=6,X7=9,A$=16,C1=4
0600 PUT #10
0610 CLOSE #10
0620 END
```

Listing 3.

```
0100 REM ************************************************
0110 REM THIS PROGRAM IS REALLY A SET OF BASIC PATCHES
```

More →

gram run.

At line 560, there is a jump to the terminal initialization routine at 9900; you can leave it out. At 570 the counter variable E is set to 1. It will be advanced so that it will be referenced when it comes time to change the value of that parameter. Note that in line 580, the string X$(4) clears the terminal. If you have some other way to do this on your terminal you'll have to use it.

From here through much of the program, you merely display the counter E and then type out a description such as INFLATION RATE PER ANNUM, followed by the variable representing that value. The variable C is the inflation rate. Line 825 stops the printing of the variables and values and allows entry of a number. Things look irregular here, but they deal with printing on the 25th line of the terminal. Discard if you have no 25th line.

Lines 880–960 cause a jump to the relevant subroutine up at 8000 to allow changing of a particular parameter. Typing in DONE jumps the user to 1000 where the town (for tax reasons) is entered. Lines 1010 and 1015

cause the data that has been entered to be stored on the disk. Next, the calculations on that data begin.

Data processing—Starting with the portion of the program in line 1020 and continuing from there to the third part of the program, the first mathematics take place. Line 1060 sends the relevant variables through a subroutine (at lines 90 to 9266) which calculates the local taxes and insurance rates for the particular area of interest. To set up your own area, you must set up each line of the subroutine for each tax entity in your area. The factors that are multiplied by the price of the house (variable D) are the ones you get from your friendly real estate agent.

Towards the end of the subroutine (line 9250 and on), you roll the variable D through some math that calculates a payment based on 30 years, 360 payments. You can add the flexibility of using other mortgage payment plans by adding some variables and prompts earlier in the program. Don't forget to add any new variables to the disk or cassette file, so that they will appear automatically in your calculations.

Listing 3 continued.

```
0120 REM THE PATCHES ALLOW YOU TO PUT THE VARIABLES ON
0130 REM THE SCREEN OF THE TERMINAL RIGHT BESIDE THE
0140 REM PROMPT. THIS ELIMINATES REFRESHING THE WHOLE
0150 REM SCREEN EACH TIME A CHANGE IS MADE. YOUR TERM-
0160 REM INAL MUST SUPPORT DIRECT CURSOR ADDRESSING.
0170 REM ************************************************
0180 REM
0190 REM
0460 DEF FNE(X)=X+1
0470 DIGITS= 0
0480 STRING= 80
0490 LINE= 132
0500 OPEN #10 , "GARBAGE" FOR UPDATE
0510 OPEN #20 , "MORGARB" FOR UPDATE
0520 FIELD #10,A=9,B=4,C=4,D=6,F=1,G=2,H=4,J=6,K=5,L=4,M=1,N=9,P=10,W=9
0530 FIELD #20,X4=6,X5=6,X6=6,X7=9,A$=16,C1=4
0540 GET #10
0550 GET #20
0560 GOSUB 9900
0570 PRINT X$(4);
0580 GOSUB 7010
0590 GOSUB 7020
0600 GOSUB 7030
0610 GOSUB 7040
0620 GOSUB 7050
0630 GOSUB 7060
0640 GOSUB 7070
0650 GOSUB 7080
0660 GOSUB 7090
0670 GOSUB 7100
0680 GOSUB 7110
0690 GOSUB 7120
0700 GOSUB 7130
0710 GOSUB 7140
0720 GOSUB 7150
0730 GOSUB 7160
0740 GOSUB 7170
0750 GOSUB 7180
0755 GOSUB 7200
0760  X=21:Y=1:GOSUB 9900:PRINT X$(2);
0770 PRINT CHR$(27);"J";
0775 INPUT "[ ]",B$
0780 IF B$="DONE" THEN 1000
0790 IF B$="" THEN 770
0800 LET Z=VAL(B$)
```

More

Listing 3 continued.

```
0810 IF Z>10 GOTO 830
0820 ON Z GOSUB 8010,8030,8020,8040,8050,8060,8070,8080,8090,8100
0825 GOTO 850
0830 LET Z=Z-10
0840 ON Z GOSUB 8110,8120,8130,8140,8150,8160,8170,8180,8260
0850 IF Z>18 THEN 770
0860 GOTO 760
1000 PRINT "IF TOWN IS ";A$;" HIT RETURN. ELSE ENTER TOWN";
1002 INPUT B$
1003 IF B$="" GOTO 1010
1005 LET A$=B$
1010 REWRITE #20
1015 REM
1020 REM ************************************************
1030 REM IN THIS PART OF THE PROGRAM, IT IS JUST LIKE
1040 REM THE ORIGINAL. YOU DO THE MATH AND SOME OTHER
1050 REM THINGS.
1060 REM ************************************************
1070 REM
7000 REM This is where we put in the values
7010  X=1:Y=1:GOSUB 9900:PRINT X$(2);
7012 PRINT "1  SALARY   =$";A;
7015 RETURN
7020  X=1:Y=45:GOSUB 9900:PRINT X$(2);
7022 PRINT "2  TAX AS ";
7024 IF M=1 THEN PRINT "SINGLE "
7026 IF M=2 THEN PRINT "MARRIED"
7028 RETURN
7030  X=2:Y=1: GOSUB 9900:PRINT X$(2);
7032 PRINT "3  RAISES % =";B;
7035 RETURN
7040  X=2:Y=45:GOSUB 9900:PRINT X$(2);
7042 PRINT "4  OTHER INCOME =$";W
7045 RETURN
7050  X=4:Y=1:GOSUB 9900:PRINT X$(2);
7052 PRINT "5  INFLATION=%";C;
7055 RETURN
7060  X=4:Y=45:GOSUB 9900:PRINT X$(2);
7062 PRINT "6 FOOD/MONTH =$";X4
7065 RETURN
7070  X=5:Y=1:GOSUB 9900:PRINT X$(2);
7072 PRINT "7  UTILS/MO =$";X5;
7075 RETURN
7080  X=5:Y=45:GOSUB 9900:PRINT X$(2);
7082 PRINT "8 AUTO EXP/MO=$";X6
7085 RETURN
7090  X=6:Y=1:GOSUB 9900:PRINT X$(2);
7092 PRINT "9  MISC/MO  =$";X7
7095 RETURN
7100  X=8:Y=1:GOSUB 9900:PRINT X$(2);
7102 PRINT "10 ASSETS/CASH $";N;
7105 RETURN
7110  X=8:Y=45:GOSUB 9900:PRINT X$(2);
7112 PRINT "11 ASSETS/DEP=$";P
7115 RETURN
7120  X=9:Y=1:GOSUB 9900:PRINT X$(2);
7122 PRINT "12 VALUE CAR=$";K
7125 RETURN
7130  X=11:Y=1:GOSUB 9900:PRINT X$(2);
7132 PRINT "13 PRICE/HM =$";D;
7135 RETURN
7140  X=11:Y=45:GOSUB 9900:PRINT X$(2);
7142 PRINT "14 DOWNPAYMENT=$";J
7145 RETURN
7150  X=12:Y=1:GOSUB 9900:PRINT X$(2);
7152 PRINT "15 THE HOME IS ";
7154 IF F=1 THEN PRINT "USED";
7155 IF F=2 THEN PRINT "NEW "
7157 RETURN
7160  X=12:Y=45:GOSUB 9900:PRINT X$(2);
7162 PRINT "16 MORT INT % =";L
7165 RETURN
7170  X=13:Y=1:GOSUB 9900:PRINT X$(2);
7172 PRINT "17 SQUARE FT =";H
7175 RETURN
7180  X=15:Y=1:GOSUB 9900:PRINT X$(2);
7192 PRINT "18 YRS REPORT ";G
7195 RETURN
7200  X=16:Y=1:GOSUB 9900:PRINT X$(2);
7202 PRINT "19 APRECIATION IN % ";C1
7205 RETURN
8000 REM REPAIR SUBROUTINES
8010 INPUT "SALARY ",A
8012 GOSUB 7010
8015 RETURN
8020 INPUT "% PAY RAISES ",B
8022 GOSUB 7030
8025 RETURN
8030 INPUT "1-IF SINGLE  2-MARRIED",M
8032 GOSUB 7020
8035 RETURN
8040 INPUT "OTHER INCOME",W
8042 GOSUB 7040
8045 RETURN
8050 INPUT "INFLATION RATE IN %",C
8052 GOSUB 7050
8055 RETURN
8060 INPUT "FOOD (MONTHLY) $",X4
8062 GOSUB 7060
8065 RETURN
8070 INPUT "UTILITIES (MONTHLY) $",X5
8072 GOSUB 7070
```

More →

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Listing 3 continued.

```
8075 RETURN
8080 INPUT "AUTOMOTIVE COSTS GAS,PAYMENT,ALL (MONTHLY) $",X6
8082 GOSUB 7080
8085 RETURN
8090 INPUT "OTHER MONTHLY LIVING COSTS $",X7
8092 GOSUB 7090
8095 RETURN
8100 INPUT "CASH ASSETS",N
8102 GOSUB 7100
8105 RETURN
8110 INPUT "HARD ASSETS (DEPRECIABLE)",P
8112 GOSUB 7110
8115 RETURN
8120 INPUT "VALUE OF CAR",K
8122 GOSUB 7120
8125 RETURN
8130 INPUT "PRICE OF HOME",D
8132 GOSUB 7130
8135 RETURN
8140 INPUT "DOWNPAYMENT",J
8142 GOSUB 7140
8145 RETURN
8150 INPUT "1-FOR USED  2-FOR NEW",F
8152 GOSUB 7150
8155 RETURN
8160 INPUT "INTEREST RATE %",L
8162 GOSUB 7160
8165 RETURN
8170 INPUT "SQ FT ENTER 0 IF UNKNOWN",H
8172 IF H=0 THEN 8200
8174 GOSUB 7170
8175 RETURN
8180 INPUT "NUMBER OF YEARS FOR REPORT",G
8182 GOSUB 7180
8185 RETURN
8200 INPUT "VALUE RANGE OF HOUSE 1-LOW 2-MED 3-HI",I
8210 IF I=1 THEN H=INT(D/35)
8220 IF I=2 THEN H=INT(D/40)
8230 IF I=3 THEN H=INT(D/45)
8235 GOSUB 7170
8240 RETURN
8260 INPUT "APRECIATION IN % ",C1
8262 GOSUB 7200
8265 RETURN
8990 REM
9000 REM ******************************************************
9010 REM FROM HERE ON TO THE END, THE PROGRAM IS THE
9020 REM SAME AS THE ORIGINAL. ALL THE TAX TABLES ARE
9030 REM HERE. IN THE CASE OF HEATHKIT H19 TERMINAL
9040 REM USERS, YOU MUST INCLUDE THE TERMINAL SUBROUTINES.
9050 REM ******************************************************
9060 REM
```

```
 1.00  SALARY $38500.00
 2.00  % PAY RAISES 8.00
 3.00  TAXED AS MARRIED
 4.00  OTHER INCOME PER ANNUM 0.00

 5.00  INFLATION RATE PER ANNUM 12.00
 6.00  PRICE OF FOOD PER MONTH 175.00
 7.00  COST OF UTILITIES PER MO. 100.00
 8.00  CAR EXPENSES INCLUDING PAYMENT PER MO. 300.00
 9.00  ALL OTHER COSTS PER MONTH 300.00

10.00  CASH ASSETS 2000.00            11.00  HARD ASSETS 2500.00
12.00  VALUE OF CAR 6600.00

13.00  PRICE OF HOME 68000.00         14.00  DOWNPAYMENT 3400.00
15.00  THE HOME IS NEW
16.00  MORTGAGE INTEREST RATE 11.50   17.00  SQ. FT. OR VAL RANGE 1,2,3 151
.00

18.00  NUMBER OF YEARS TO REPORT 5.00
19.00  APPRECIATION % 10.00
```

Listing 4.

Back at the program, line 1080 sends you to the married or unmarried tax tables at lines 9000 or 9100. Looking at the tables at 9000, the single tables, you will see that this is the back page of the instruction booklet for calculating your own taxes for the IRS form 1040. You set Q=0, and if the table gives it a value, you exit the tables and return from the subroutine. Say your earn $20,000. If you compare the income variable A with $108,300, you see that the routine scoots you along to the next line. In line 9040 the variable A finally meets the compare criteria. Mainly, A is greater than $18,200 so the tax is calculated to be $3565 plus 34 percent of the remaining amount over $18,200. Now Q has a value greater than 0 so line 9041 ends the subroutine.

Note that the preceding tax calculations are done with no dependents. If you have dependents, you need to subtract the standard deduction for each before you enter the single or married tax tables.

With the tax calculated, you need only to figure the Social Security withholding. This is done back at line 1090.

Data out—Starting at line 1100, the printout section of the program begins. Calculations must still be done, but they will be done as the data is printed. The data collected so far and some other data is used to create the first-year display. At the end of the first-year display, after you've had a chance to observe the end totals, you can display the coming years as you have chosen, or you can go back and adjust your figures. If you get too discouraged after the first year, you can just quit.

All these choices come in lines 1240-1290. Beginning at line 1300, you do the recalculations and displays for the series of years you requested in the early part of the program. Note that you adjust the income variable A for pay raises, then recalculate the taxes. You also calculate expenses each year, taking into account the effect of inflation. Look at lines 1500 through 1570. Here you are holding some of the values that are changing and then sending things back through the tax tables to calculate tax benefits of home ownership, taxes with new income and so on.

Summary

Listing 4 is a sample run. You can see how each of the variables is affecting the outputs. In cases where you will be adding new variables for consideration, keep in mind the three basic sections of the program and be sure to add your new variable in each appropriate section.

Especially keep in mind the subroutines starting at 8000 labeled as the repair subroutines. They're really a part of the input portion of the program. If you forget to put your new variable in subroutine 8000, you won't be able to change its value in succeeding calculations, and you'll get wrong answers.

And finally, a reminder not to forget to add your new variables to the disk or cassette files so that you will not have to reenter the value each time you run the program.■

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These Z-80 and 8080 multiple interval timer programs provide exact delays and eliminate guesswork.

Surefire Timer Programs

By Lee Bonnifield

I don't like many of the *ad hoc* delay routines I find. They're hard to understand, I don't know how long they are supposed to delay, and I'm not sure of the clock rate at which they are intended to operate. If I switch clock rates from 2 MHz to 4 MHz, I'm sure I need to adjust the routines, but it isn't obvious how to do it. The routines sometimes affect flags or registers, so they generally can't be used by other programs.

The 58 bytes of the Multiple Interval Timer program solve those problems. No registers or flags are changed when these delay routines are called. In some cases the B register is used to pass a parameter. Listing 1 shows the routines as they would appear if you assembled the code under CP/M to run on a 4 MHz Z-80 microprocessor. Listings 2 and 3 show modifications for other systems.

The listings are shown as if assembled at 0100 (hexadecimal), but you'll probably want to put them in read-only memory, where they'll always be available. If you sometimes change the speed at which your system operates, the one byte labeled DELCONST should be in programmable memory.

If you include a CALL SMSEC instruction in one of your programs, your processor will be tied up for exactly 250 T-states or clock cycles (e.g., there are 4 million T-states (cycles) per second in a clock running at 4 MHz): 17 for the CALL, 69 for the instructions in SMSEC except for the

Address correspondence to Lee Bonnifield, 1025 Chalk Level Road, Durham, NC 27704.

Listing 1. These subroutines can be assembled by CP/M for execution on a 4 MHz Z-80. They provide convenient general-purpose delays ranging from 62.5 µs to 255 seconds. The millisecond and fractional millisecond delays claimed are exact if your clock rate is exactly 4 MHz and there are no wait states.

```
                        ; Multiple interval timer for 4 MHz Z-80
                        ; Lee Bonnifield
                        ; 1025 Chalk Level Rd - Durham NC 27704

0100                            ORG     0100H

                        ; This sets the number of times the
                        ; innermost loop at L3 will be executed
000D =                  LOOPS           EQU     13

                        ; Define the Z-80 instruction to CP/M
0010 =                  DJNZ            EQU     10H

                        ; Delay number of seconds in B register
0100 C5F5               BSEC:           PUSH B ! PUSH PSW
0102 CD0A01             L1:             CALL    SEC
0105 10FB                               DB      DJNZ,L1-$-1 AND 00FFH
0107 F1C1                               POP PSW ! POP B
0109 C9                                 RET

                        ; Delay 1 second
010A CD0D01             SEC:            CALL    HSEC

                        ; Delay 1/2 second
010D CD1001             HSEC:           CALL    QSEC

                        ; Delay 1/4 second
0110 C5                 QSEC:           PUSH    B
0111 06FA                               MVI     B,250
0113 CD1801                             CALL    BMSEC
0116 C1                                 POP     B
0117 C9                                 RET

                        ; Delay number of milliseconds in B register
0118 C5F5               BMSEC:          PUSH B ! PUSH PSW
011A CD2201             L2:             CALL    MSEC
011D 10FB                               DB      DJNZ,L2-$-1 AND 00FFH
011F F1C1                               POP PSW ! POP B
0121 C9                                 RET

                         ;Delay 1 millisecond
0122 CD2501             MSEC:           CALL    HMSEC

                        ; Delay 1/2 millisecond (500 µsec)
0125 CD2801             HMSEC:          CALL    QMSEC

                        ; Delay 1/4 millisecond (250 µsec)
0128 CD2B01             QMSEC:          CALL    EMSEC

                        ; Delay 1/8 millisecond (125 µsec)
012B CD2E01             EMSEC:          CALL    SMSEC
```

More →

DJNZ, eight for the last execution of the DJNZ and 156 for the first 12 executions of the DJNZ. If your clock rate is exactly 4 MHz (and there are no wait states), exactly 62.5 μs will be consumed before your processor starts on the instruction following the CALL SMSEC. This minimum delay is one-Sixteenth of a MilliSECond; hence the acronym SMSEC.

It's simple to keep exactly doubling the delays with the earlier entry points for 1/8 ms, 1/4 ms, 1/2 ms and 1 ms. If you want a delay in the range of 2 to 255 ms, store the appropriate hexadecimal value (02 to 0FF) in the B register and CALL BMSEC.

If you have a 2 MHz Z-80, it's best to abandon the SMSEC entry point. Listing 2 shows the modification. This is a particularly useful version if you sometimes run at 4 MHz, because by changing the value at DELCONST to 32, the routines will work at 4 MHz almost as precisely. A CALL MSEC will consume .994 ms, close enough for all my needs.

Users with 8080s will have to change all the DJNZ instructions to DCR B ! JNZ instructions, taking a few more bytes and T-states. Listing 3 shows a way to achieve exact accuracy on a 2 MHz 8080.

The routines can be used with odd clock rates or wait states if you experiment with the value at DELCONST.

Listing 1 continued.

```
                ; Delay 1/16 millisecond (62.5 μsec)
012E C5         SMSEC:  PUSH    B               ; 11 T-states
012F F5                 PUSH    PSW             ; 11
0130 3A3901             LDA     DELCONST        ; 13
0133 47                 MOV     B,A             ;  4
0134 10         L3:     DB      DJNZ            ;      13 for B>1
                                                ;       8 for B=1
                                                ; ______________
0135 FE                 DB      L3-$-1 AND 0FFH ; 13(LOOPS-1) + 8
0136 F1                 POP     PSW             ; 10
0137 C1                 POP     B               ; 10
0138 C9                 RET                     ; 10

                ; Total T-states for CALL SMSEC:
                ; 17 + 69 + 13(LOOPS-1) + 8 = 250
                ; At 4 MHz, 250 T-states = 62.5 μsec

0139 0D         DELCONST:       DB      LOOPS

013A                    END     0100H
```

```
                ; Multiple interval timer for 2 & 4 MHz Z-80
                ; All omitted lines are not
                ; changed from listing 1
                ; ...
                ; ...
                ; ...
0128 CD2B01     QMSEC:          CALL    EMSEC

                ; Delay 1/8 millisecond (125 μsec)
012B C5         EMSEC:  PUSH    B               ; 11 T-states
012C F5                 PUSH    PSW             ; 11
012D 3A3601             LDA     DELCONST        ; 13
0130 47                 MOV     B,A             ;  4
0131 10         L3:     DB      DJNZ            ;      13 for B>1
                                                ;       8 for B=1
                                                ; ______________
0132 FE                 DB      L3-$-1 AND 0FFH ; 13(LOOPS-1) + 8
0133 F1                 POP     PSW             ; 10
0134 C1                 POP     B               ; 10
0135 C9                 RET                     ; 10
                ; Total T-states for CALL EMSEC:
                ; 17 + 69 + 13(LOOPS-1) + 8 = 250 if LOOPS=13
                ;                            = 497 if LOOPS=32
                ; At 2 MHz, 250 T-states = 125 μsec
                ; At 4 MHz, 497 T-states = 124.25 μsec

0136 0D         DELCONST:       DB      LOOPS
                ; For 4 MHz operation, change the
                ; value at DELCONST from 13 to 32

0137                    END     0100H
```

Listing 2. This modification to Listing 1 provides exact delays at the millisecond and fractional millisecond entry points for a 2 MHz Z-80. Changing the value of DELCONST allows for almost exact operation at 4 MHz.

Greater precision can be obtained by eliminating the entry points for the shortest delays, as SMSEC was eliminated from Listing 2 and 3. This allows DELCONST to be larger, so that adjustments to it are finer. You'll probably never need accuracy closer than a few percent.■

```
                        ; Multiple interval timer for 8080
                        ; All omitted lines are not
                        ; changed from listing 1
                        ; ...
000D =                  LOOPS           EQU     10
                        ; ...
                        ; no need to define DJNZ
                        ; ...
                        ; ...
                        ; ...
0102 CD0C01             L1:             CALL    SEC
0105 05                                 DCR     B
0106 C20201                             JNZ     L1
                        ; ...
                        ; ...
                        ; ...
011C CD2601             L2:             CALL    MSEC
011F 05                                 DCR     B
0120 C21C01                             JNZ     L2
                        ; ...
                        ; ...
                        ; ...
                        ; Delay 1/4 millisecond (250 µsec)
012C CD2F01             QMSEC:          CALL    EMSEC

                        ; Delay 1/8 millisecond (125 µsec)
012F C5                 EMSEC:  PUSH    B               ; 11 T-states
0130 F5                         PUSH    PSW             ; 11
0131 3A3F01                     LDA     DELCONST        ; 13
0134 3A3F01                     LDA     DELCONST        ; 13
0137 47                         MOV     B,A             ;  5
0138 05                 L3:     DCR     B               ;      5
0139 C23801                     JNZ     L3              ;     10
                                                        ; __________
                                                        ; 15 * LOOPS
013C F1                         POP     PSW             ; 10
013D C1                         POP     B               ; 10
013E C9                         RET                     ; 10
                        ; Total T-states for CALL EMSEC:
                        ; 17 + 83 + 15*LOOPS = 250
                        ; At 2 MHz, 250 T-states =125 µsec

013F 0A                 DELCONST:       DB      LOOPS

0140                            END     0100H
```

Listing 3. This modification to Listing 1 provides exact delays at the millisecond and fractional millisecond entry points for a 2 MHz 8080. Notice that an 8080 requires more T-states (clock cycles) for some instructions than a Z-80.

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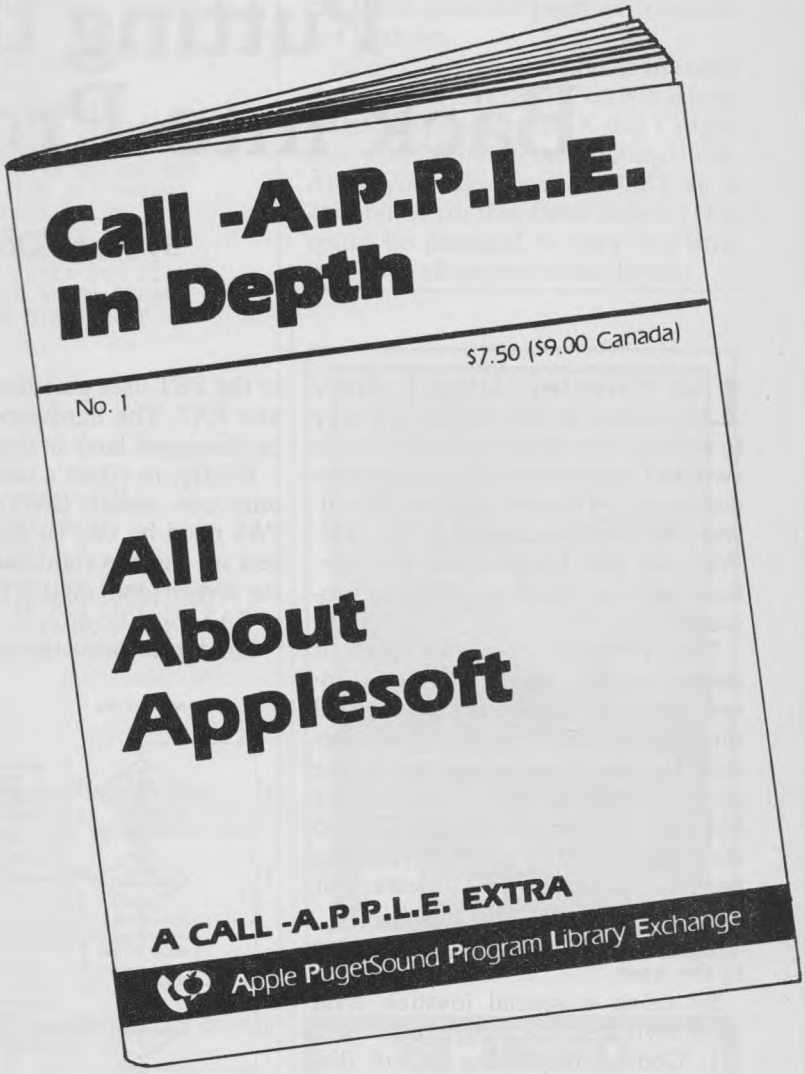

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If you can write on the PET with a few switches, why not program the PET with them? Here's how.

Putting the Joy Back into Programming

By Frank Donato

Last November, Alfred J. Bruey described in this magazine a way to write on the screen of the PET with switches attached to the application connector ("Microcomputer Hardware for the Handicapped," p. 173). Why not take his idea one step further, and use these switches to program?

This program does just that. It makes the PET execute a special insert program just before its normal interrupt routine, every 1/60 of a second, by changing the address of the interrupt routine (from E685 on the old PET or 2EE6 on the new PET) to the routine at 033A and then jumping back to the regular PET interrupt at the above address. (See Fig. 1.)

The program, then, runs invisible to the user.

By using a special joystick with three switches, the programmer can:

1. Control displaying or not displaying (normal PET operation) a subset of ASCII characters on the top right-hand corner of the PET screen.
2. Take the character displayed and place it at the current cursor position on the line and in the keyboard buffer.
3. Force a carriage return.

I use three microswitches attached to the PET user port lines, PA5, PA6 and PA7. The hardware details will be discussed later in this article.

Briefly, to effect a carriage return, only one switch (SW1) attached to PA5 need be on. To display characters on the top right-hand corner of the screen (scan mode), SW2 attached to PA7 must be on.

Finally, to print the character currently displayed, both the scan switch SW2 (PA7) and the print switch SW3 (PA6) must be on.

You can do the same with only two switches: one for scan and one for print. You could carriage return when a special character is displayed. But the scan rate must be slow (each character is displayed for about one second), and so the third switch for a carriage return lets you do this at any time. Of course, this makes the hardware more complex. Fig 2. is a flowchart of the program.

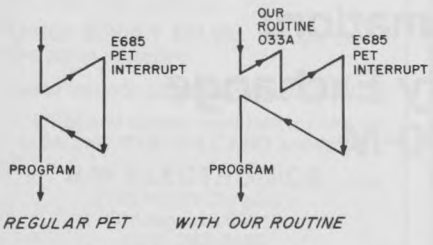

Fig. 1. Special insert program modification.

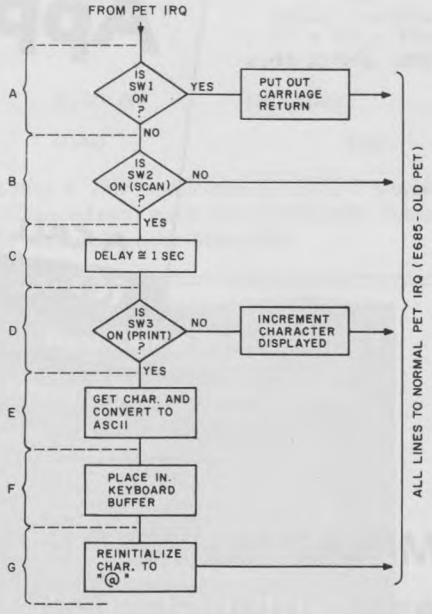

Fig. 2. Program flowchart.

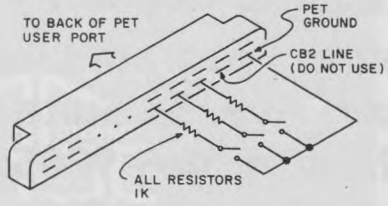

Fig. 3. Grounding through a 1k resistor.

Details of Program

Block A, lines 160 to 180 of assembly. The accumulator is loaded with the contents of the PET user port (port A of the 6522 VIA at address E84F). A check is made to see if the byte here is equal to DF (11011111). That is, is bit 5 zero? If it is, indicating SW1 is on (carriage return), you jump to line 580.

At line 580 the X-register is loaded with the number of characters in the keyboard buffer and the accumulator is loaded with a carriage return (0D).

The VIA register is reread until it no longer shows a carriage return (SW1 released). The accumulator is then placed in the keyboard buffer, thus effecting a carriage return. This method of rereading the VIA port acts as a debounce and ensures that only one carriage return is done when the switch is released.

Address correspondence to Frank Donato, 1306 Wedgewood Drive, Sudbury, Ontario P3A 3E2, Canada.

Note that the keyboard buffer holds only ten characters so that when the buffer pointer is ten, it must be reset to 0. After this you jump to the regular PET interrupt (line 690).

```
                0010 ;*******************************
                0020 ;*** JOYSTICK PROGRAMMER FOR ***
                0030 ;*** THE CBM P.E.T.          ***
                0040 ;*** BY FRANK DONATO         ***
                0050 ;*** DEC 30, 1980           ***
                0060 ;*******************************
                0070 ;
                0080 ;
                0090 COUNT      .DE $03B3 ;TIMING COUNT
                0100 PORT       .DE $E84F ;USER PORT
                0110 INT        .DE $E685 ;PET INTERRUPT
                0120 SCREEN     .DE $804F ;WHERE CHAR IS DISPLAYED
                0130 KBUFF      .DE $020F ;KBD BUFFER
                0140 NCHAR      .DE $020D ;NO OF CHRS IN KBD BUF
                0150            .BA $033A  ;LOCATION OF PROGRAM
033A- AD 4F E8  0160            LDA PORT  ;LOAD PORT VALUE
033D- C9 DF     0170            CMP #DF   ;IS THERE A CR ?
033F- F0 53     0180            BEQ OUT1  ;IF SO OUTPUT ONE
0341- C9 7F     0190            CMP #7F   ;IF NOT CHECK FOR SCAN
0343- D0 40     0200            BNE NSCAN  ;IF NOT GO TO NSCAN
0345- A9 03     0210            LDA #03   ;IF SCAN START LOOP
0347- 8D B3 03  0220            STA COUNT
034A- A2 FF     0230 LP1        LDX #FF
034C- A0 FF     0240 LP2        LDY #FF
034E- 88        0250 LP3        DEY
034F- D0 FD     0260            BNE LP3
0351- CA        0270            DEX
0352- D0 F8     0280            BNE LP2
0354- CE B3 03  0290            DEC COUNT
0357- D0 F1     0300            BNE LP1  ;END OF TIMING LOOP
0359- AD 4F E8  0310            LDA PORT  ;GET PORT VALUE
035C- C9 3F     0320            CMP #3F   ;DO WE PRINT ?
035E- F0 06     0330            BEQ PRNT  ;IF SO GO TO PRNT
0360- EE 4F 80  0340            INC SCREEN  ;IF NOT INC SCREEN CHAR
0363- 4C 85 E6  0350            JMP INT  ;AND GO TO REG INTERRUPT
0366- AD 4F 80  0360 PRNT       LDA SCREEN  ;GET CHAR TO PRINT
0369- 48        0370            PHA  ;START OF ASCII CONVERSION
036A- 29 20     0380            AND #20
036C- D0 04     0390            BNE AS2
036E- 68        0400            PLA
036F- 09 40     0410            ORA #40
0371- 48        0420            PHA
0372- 68        0430 AS2        PLA
0373- 29 7F     0440            AND #7F   ;END OF ASCII CONVERSION
0375- AE 0D 02  0450            LDX NCHAR ;GET # OF CHRS IN BUF
0378- 9D 0F 02  0460            STA KBUFF,X ;STORE CHR IN BUF
037B- E8        0470            INX  ;INC THE POINTER
037C- E0 0A     0480            CPX #0A   ;ARE THERE 10 ?
037E- D0 02     0490            BNE NFL   ;BRANCH IF NOT FULL
0380- A2 00     0500            LDX #00   ;IF FULL RESET TO 0
0382- 8E 0D 02  0510 NFL        STX NCHAR  ;PUT POINTER BACK
0385- A9 00     0520 NSCAN      LDA #00 ;RESET CHAR
0387- 8D 4F 80  0530            STA SCREEN  ;PUT BACK ON SCREEN
038A- AD 4F E8  0540 CHK        LDA PORT  ;CHECK PORT
038D- C9 63     0550            CMP #63   ;IS SCAN & PRINT STILL ON ?
038F- F0 F9     0560            BEQ CHK   ;KEEP CHECKING IF SO
0391- 4C 85 E6  0570            JMP INT ;IF NOT TO INT.
0394- AE 0D 02  0580 OUT1       LDX NCHAR ;GET POINTER TO BUF
0397- A9 0D     0590            LDA #0D   ;LOAD A WITH A CR
0399- 9D 0F 02  0600            STA KBUFF,X  ;PUT OUT THE CR
039C- E8        0610            INX  ;INCREMENT POINTER
039D- AD 4F E8  0620 CHK2       LDA PORT  ;GET PORT VALUE
03A0- C9 DF     0630            CMP #DF   ;IS A CR STILL THERE
03A2- F0 F9     0640            BEQ CHK2  ;IF SO KEEP CHECKING
03A4- E0 0A     0650            CPX #0A   ;10 CHARS IN BUFFER?
03A6- D0 02     0660            BNE STOR  ;PUT POINTER BACK IF NOT
03A8- A2 00     0670            LDX #00  ;OTHERWISE RESET POINTER
03AA- 8E 0D 02  0680 STOR       STX NCHAR  ;POINTER IS BACK
03AD- 4C 85 E6  0690            JMP INT  ;TO PET INTER
LABEL FILE:  [ / = EXTERNAL ]   .EN

/COUNT=03B3          /PORT=E84F          /INT=E685
/SCREEN=804F         /KBUFF=020F         /NCHAR=020D
LP1=034A             LP2=034C            LP3=034E
PRNT=0366            AS2=0372            NFL=0382
NSCAN=0385           CHK=038A            OUT1=0394
CHK2=039D            STOR=03AA
//
0000
```

Program listing.

Block B, lines 190 to 200. If there is no carriage return, you check for a scan. You check the accumulator to see if PA7 is on (indicating scan). If not, you branch to line 520 where you reset the displayed character to @ and then jump to the regular PET interrupt (lines 570).

Note that checking the port (lines 540–560) has no effect is this case because the scan and print switches are not both on.

Block C, lines 210 to 300. If the scan switch is on (SW2), you wait in a loop effected by loading the X and Y registers with FF and decrementing them. Also, you use location 03B3 as a counter to do this three times. (This could be changed to vary the time that each character is displayed.)

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Block D, lines 310 to 350. After the loop, you load the accumulator with the A port, and check if SW2 and SW3 are on by comparing with 3F (this would indicate print the character displayed). If not, you increment the value of the displayed character and jump to the PET interrupt (this is scan condition only; SW2 on and SW3 off).

Block E, lines 360 to 570. If both SW2 and SW3 are on, (indicating print condition), you jump to line 360. Here the accumulator is loaded with the screen code for the character displayed. It is converted to ASCII by the routine in lines 370 to 440. The X-register is loaded with the number of characters in the keyboard buffer, and then the accumulator (now ASCII value) is stored in the keyboard buffer. The screen character is now reset to @. The VIA port is reread and the program does not continue until the switches are released. Again, this provides debounce and prevents multiple prints. As soon as the switches are released, the program jumps to the PET interrupt (line 570).

Note that if none of the switches are on, that is, if the joystick is in the center position, the PET acts normally except the character @ is at the top right-hand corner.

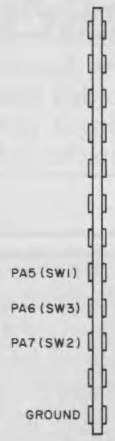

Fig. 4.

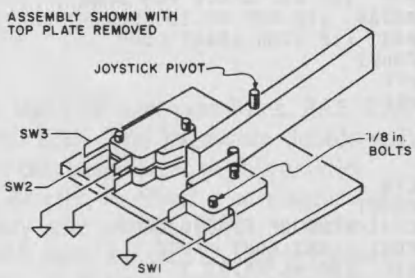

Fig. 5.

Hardware

The hardware was probably the most difficult part of this project. Since the PET resets the VIA so that the A port is normally on input and at +5 V, to sense a switch closure, the line involved would have to be grounded. This is done through a 1k resistor. The schematic in Fig. 3 shows this modification.

Note that PA5, PA6 and PA7 are located on the bottom part of the user port as in Fig. 4.

The three 1k resistors are soldered to the bottom of the connector and lines from these go to three microswitches sandwiched between two plates. A flat bar of aluminum is pivoted between these and acts as the joystick (see Fig. 5).

Note that SW2 and SW3 are set so that, as the joystick is moved, SW2 is on first; then, by moving the joystick a bit more, SW3 also goes on. This is done by bending the microswitch levers.

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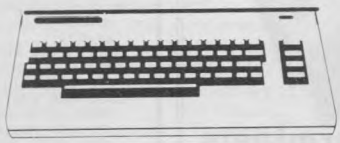

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After suitable adjustment of the joystick (the switches can be checked with an ohmmeter), the program can be tested. Of course, the program can be tested without the complexity of the above hardware by attaching some simple switches, as in Fig. 3.

Implementation

To implement the program the following steps should be taken:

1. The joystick is connected to the PET user port.

2. The main program is written in the second cassette buffer starting at 033A. This can be done with "TIM" or in the case of a new PET, the machine-language monitor (POKEs from BASIC could also be used).

3. The interrupt vector is changed to point to 033A, using TIM or the monitor (do not use POKEs).

On the old PET this is done by changing locations 0219–021A from 85E6 to 3A03, respectively, 0090–0091 from E62E to 3A03, respectively, on the new PETs, or 0090–0091 from 55E4 to 3A03 for PETs with 4.0 BASIC. Of course nothing happens except the character @ is displayed on the top right-hand corner.

When the paddle is moved so that SW2 is activated, the character should start changing. When the desired character is shown, move the lever further so that SW3 is also activated. When the paddle is released, the character should appear at the cursor position and the character on the screen should revert back to @. We can continue scanning and printing by repeating the above procedure.

Once the line is completed, move the paddle so that SW1 is activated. This will cause a carriage return and move the cursor to the next line.

For example, using the above procedure, if a line is filled with ?3*4 and a carriage return is now done (SW1 on), the PET should print 12. It should then automatically print READY. In short, it acts like a normal PET.

	Old PET	New PET	4.0 BASIC
INT	E685	2EE6	E455
KBUFF	020F	026F	026F
NCHAR	020D	009E	009E

Table 1.

Note that the listing is for an old PET. For new PETs, addresses to be changed are shown underlined in the listing and are shown in Table 1.

Conclusion

One disadvantage of the above is the speed of programming. It is slow. However, it opens opportunities for some people to express themselves.

Also, some of the above methods could be used in other programs or games.

The hardware could be varied. For example, for people with gross-motor capability only, the joystick could be mechanically altered to be less sensitive. Instead of a joystick, a foot control, head control or other means could be used.

The timing loop used in displaying the character could be varied in length to suit the programmer. The present method of displaying the character could be varied by possibly displaying all the characters in a matrix format and having a moving cursor point to each character in an X-Y coordinate mode. This would speed up character choosing but would take up more screen area.■

✓See List of Advertisers on page 210

This author put the Apple III through its paces and found more than one application for this versatile new machine.

How Does the Apple III Stack Up?

By James E. Kelley, Jr.

About four months ago an Apple III (128K) took up residence in my engineering management consulting business, accompanied by a NEC Spinwriter (5515), a second disk drive and a black and white monitor.

I needed word processing for writing and indexing procedures manuals and for preparing technical reports and marketing materials. I also wanted program development capability for producing commercial-quality software packages. My other applications are proprietary, but are intended to exploit computer graphics and to involve top executives more personally in the use of microcomputers in their businesses.

A third application, the one my friends say is the real justification, is the analysis, comparison and classification of medieval marine charts—a long-standing interest of mine.

The Bare Bones

What comes with the Apple III? There is an owner's guide with system utilities disk, a standard devices drivers manual with Apple II emulation disk, an Apple Business Basic reference manual with system disk, Apple II DOS manual with DOS 3.3 system master and DOS 3.3 BASIC disks, two VisiCalc manuals with sampler and system disks, a system demonstration disk and two blank disks.

Address correspondence to James E. Kelley, Jr., 7602 Spring Ave., Melrose Park, PA 19106.

That is not very much. But I knew in advance that I'd be a pioneer with the new machine, and would have a lot of development work to do.

When I placed my order last fall I expected to get Apple's word processor with the equipment. I understand delivery has been delayed until 1982! Since I really needed a word processor, my dealer recommended Muse Software's Supertext for the interim. This package was developed for Apple II, but fortunately it works under the emulator.

I have been using this word processing package for several months, and although it's doing the job, it's not something I want to live with forever. Using control characters for uppercase letters and other functions is certainly awkward, and it's inappropriate for the Apple III. I have to insert four disks just to get started each session. The package is unforgiving if you accidentally hit the wrong key under emulation, so frequent saves are your only insurance against redoing large blocks of text.

Getting Started

With a little instruction from the dealer I started wading through the manuals. I soon found that you need to know something about the Apple II—the manual writers tacitly assume that the reader has experience with the earlier machine. Be sure to buy some of the Apple II manuals, especially the Applesoft and the Apple II reference manuals.

One of the quickest ways to learn the fundamentals of this equipment is to print out and study a copy of the various BASIC programs that come on the demonstration and the Apple Business Basic disks. They are mostly well-documented with remarks. You can follow what they do by blocking off sections of the programs with END statements and then executing them. There are a number of demos in Integer and Applesoft BASIC on the DOS 3.3 system master which are also useful to print out and study.

There is a helpful Pascal subroutine (READCRT.INV) on the BASIC disk which reads the Text mode console screen. To my knowledge, none of the reference manuals tells how to do this, or even refers to this subroutine.

Plaudits

I was concerned that reading screen text for long periods would bother my eyes, but this has not happened. I like the 80-character per line format, with upper- and lowercase letters. It is much superior to Apple II's 40-character format.

The Apple III provided my first experience with interactive programming. It's great—I've never written and debugged programs so rapidly. Every programmer should have this facility. Your debugged product can be compiled into machine language later on.

The edit feature is especially convenient. You can move the cursor all over the screen so you can assemble lines of coding from previously keyed material or insert corrections at will.

Text and Program Manipulation

The string manipulation features of Apple II have been extended on the Apple III to include HEX$ (decimal to hexadecimal conversion), TEN (hex to decimal), INSTR (first position of a substring) and SUB$ (substring replacement). The related CONV(ert) commands, also new, permit all datatype conversions among real, integer, string and long integer expressions.

A really nice feature of the Apple Business Basic is the ability to LIST programs, or sections of them, to a Text file and then to read them back with an EXEC(ute) command. This lets the programmer manipulate programs within BASIC. For instance, I store useful subroutines as Text files, to be called when assembling a program by the appended utility, called PATCH, which is temporarily stored at high number-line positions. This utility renumbers the subroutine and inserts it in the program being assembled (using the EXEC command). Indeed, PATCH itself is called as needed using the EXEC command, and then deleted when no longer needed.

Unfortunately, the LIST and DEL commands currently accept only explicit values of line numbers and not variables whose values can be substituted under program control. Further, the DEL command does not function in deferred mode, but requires direct operator involvement in utilities using it. The EXEC command works in deferred mode if the file pathname is placed in quotes (not mentioned in the manuals).

Since the EXEC command imitates keyboard input operation, the statements need not be in ascending sequence in the text file. This makes a limited form of numeric sorting possible. Generate BASIC REM statements, where the statement numbers are the sort keys, and the records or record identifiers are stored behind the REM. Distribute these statements to a text file and read back using an EXEC command. Voila! They are in sort order in the instruction memory. Now list them back to a text file and input them to a file for further processing under BASIC program control.

I have also used the program memory for dated text items (e.g., bibliographic references, follow-up notes). The date (or reasonable facsimile) provides the line number, a REM command avoids syntax tests, an additional digit or two provide a secondary classification (e.g., type of bibliographic item, individual involved or type of follow-up action), and finally the text in English (all in under 255 characters). This information is saved in a Text file, and read back using the EXEC command, to be updated just as you would correct a BASIC program using the cursor controls. A simple print program, selecting on the secondary classification if desired, provides up-to-date bibliographic or follow-up lists by individual or function.

Quibbles

For an old FORTRAN programmer, the Apple Business Basic I/O statements are unnecessarily confusing and unwieldly. The use of INPUT/PRINT and READ/WRITE commands depends on the type of file addressed, and the punctuation of the variable list (commas and semicolons) varies with the device type. I'm forever making syntax errors. Handling of arrays during I/O is also inconvenient compared to FORTRAN. I'm not sure yet what strategy to follow in designing file layouts to get the best speed of operation. More information on how BASIC handles I/O commands internally would be helpful here.

A simple program listing requires typing many characters, and I am forever doing it wrong. Here's the full sequence:

open#3,''.printer'':output#3:list:output#0:close#3:end.

I usually put this sequence at the end of my programs for easy call with a GOTO. I suppose these complications can be justified by the flexibility they provide—like the abominable JCL (job control language) of the IBM 360s and 370s.

In my shop, certain file numbers are standard, like standard device numbers on the old IBM systems (e.g., 1 = console [keyboard and screen], 3 = printer; 4 = graphics, etc.). When I pick up a piece of coding and read PRINT#3 I know automatically that the NEC Spinwriter is the device involved.

Big Disappointment

My biggest disappointment is being locked out of the system. No way is currently provided for programming in machine language. POKE, PEEK and CALL are not in Apple Business Basic's vocabulary. BASIC is fine for interactive operations at the console. But because it's interpretive, it's much too slow to exploit Apple III's intrinsic capabilities for number crunching, array handling or involved string manipulation. I like the idea of writing mainlines and most I/O and other overview functions in BASIC (for easy debugging at the console), while writing the inner loops (where time counts) in machine or a compiled language (e.g., Pascal,

Program listing. PATCH programming aid.

```
63000  REM  ************************************************************
63005  REM  * 5/29/81                                          VER 0.1  *
63010  REM  *                    ***  PATCH  ***                         *
63015  REM  *                                                           *
63020  REM  *            An APPLE III Programer's Aid                   *
63025  REM  *                                                           *
63030  REM  *                    Developed by:                          *
63035  REM  *                                                           *
63040  REM  *                JAMES E. KELLEY, JR.                       *
63045  REM  *                Melrose Park, Penna.                       *
63050  REM  *                                                           *
63055  REM  *                                                           *
63060  REM  ************************************************************
63065  DIM stmt$(200):GOTO 63620
63070  :
63075  REM   ***  PULL OUT STATEMENT #  ***
63080  line$=""
63085  line$=line$+b$:IF a%=LEN(string$) THEN 63110
63090  a%=a%+1:b$=MID$(string$,a%,1)
63095  IF b$<"0" OR b$>"9" THEN 63110:ELSE 63085
63100  :
63105  REM   ***  CALC EQUIVALENT STMNT #  ***
63110  FOR i=1 TO lim:IF line$=stmt$(i) THEN 63120
63115    NEXT:nline$=line$:RETURN
63120  nline$=STR$(min+dif*(i-1)):RETURN
63125  :
63130  REM   ***  ASSEMBLE OUTPUT STRING  ***
```

More →

FORTRAN).

Pascal, when it's available, is supposed to substitute for coding in machine language. Or perhaps it will provide the means to get directly at the 6502A and give the user true ownership and control of his equipment.

For me, being locked into BASIC exclusively means deferring the development of commercial-quality systems. The graphics die in BASIC. Image development is too slow for interactive graphics—rubber-banding and the like. At least I'm not smart enough to do these things effectively with the currently available facilities for Apple III.

Glitches

Three valuable Applesoft program statements have been omitted in Apple Business Basic: FLASH (causes text to blink), ROT(ate) (a shape) and SCALE (a shape). SCALE is still in the vocabulary, but it now relates to formatting output for printing.

The first version of the BASIC system has serious bugs in the graphics package. When you use mode 2 (high-resolution) to plot data or to read the screen in the horizontal range of 512, the image is recorded in the range 256. I first encountered this when dumping a picture on the demonstration disk from the mode 2 buffer to the printer while experimenting with the NEC Spinwriter's graphics. I thought I had an error in my program. But the problem also arises when you plot curves on the high-resolution screen.

The Newfont and Drawimage features of the graphics package do not give correct results either. If you try the explanatory example in the manual you'll find this to be true.

Comments on PATCH

PATCH is to be stored as a text file and called by the statement EXEC .D2/PATCH. It is read into memory without disturbing the program in residence unless it has statement numbers of 63000 or more. Enter PATCH with a GOTO 63000. The menu will be displayed (lines 63615–63675).

In operation, PATCH is pretty well self-explanatory. However, I'm sure it won't handle all possible error conditions, although those which I commonly make are programmed to give me a second chance.

Four working options are available in PATCH as currently written:

Listing continued.

```
63135  out$=LEFT$(string$,m%)+nline$:d%=LEN(string$)-m%-LEN(line$)
63140  IF d%<=0 THEN string$=out$:RETURN
63145  string$=out$+RIGHT$(string$,d%):RETURN
63150  :
63155  REM   ***  Process THEN, ELSE & USING  ***
63160  a%=INSTR(string$,c$,i%):IF a%=0 THEN RETURN:REM No more THEN's
63165  b$=MID$(string$,a%+j%,1):IF b$<"0" OR b$>"9" THEN i%=a%+j%:GOTO 6316
       0
63170  a%=a%+j%:m%=a%-1:GOSUB 63080:GOSUB 63135
63175  IF d%>j% THEN i%=LEN(string$)-d%:GOTO 63160
63180  RETURN
63185  :
63190  REM   ***  Process GOTO, GOSUB  ***
63195  a%=INSTR(string$,c$,i%):IF a%=0 THEN RETURN:REM No more GOTO's
63200  b$=MID$(string$,a%+j%,1):IF b$<"0" OR b$>"9" THEN i%=a%+j%:GOTO 6319
       5
63205  a%=a%+j%:m%=a%-1
63210  GOSUB 63080:GOSUB 63135
63215  IF d%<=0 THEN RETURN
63220  m%=m%+LEN(nline$)+1:b$=MID$(string$,m%,1)
63225  IF b$="," THEN a%=m%+1:b$=MID$(string$,a%,1):GOTO 63210
63230  IF d%>j% THEN i%=LEN(string$)-d%:GOTO 63195
63235  RETURN
63240  :
63245  REM   ***  MAIN LINE  ***
63250  :
63255  INPUT#6;string$:IF LEN(string$)<=0 THEN PRINT#7;string$:GOTO 63255
63260  :
63265  REM  Process STATEMENT #
63270  a%=1:line$="":GOSUB 63090:d%=LEN(string$)-LEN(line$)-1
63275  string$=blnk$+nline$+RIGHT$(string$,d%)
63280  i%=1:c$="THEN":j%=5:GOSUB 63160:REM "THEN"
63285  i%=1:c$="ELSE":j%=5:GOSUB 63160:REM "ELSE"
63290  i%=1:c$="GOTO":j%=5:GOSUB 63195:REM "GOTO"
63295  i%=1:c$="GOSUB":j%=6:GOSUB 63195:REM "GOSUB"
63300  i%=1:c$="USING":j%=6:GOSUB 63160:REM "USING"
63305  PRINT#7;string$:GOTO 63255:REM Get next input string
63310  :
63315  REM   ***  INITIALIZE  ***
63320  work$=".d2/renumworkfile":ON ERR GOTO 63450:CREATE work$, TEXT
63325  OFF ERR:lim%=200:qt$=CHR$(34):blnk$=CHR$(32)
63330  PRINT:PRINT"Is Routine Currently in MEMORY (Y/N)";:INPUT q$
63335  jmp=1:IF q$="y" THEN jmp=2:x=1:GOTO 63470:REM Go CAPTURE Routine
63340  PRINT:PRINT:INPUT"KEY Pathname of SOURCE Routine: ";name$
63345  :
63350  REM   ***  SET UP STMT$ TABLE  ***
63355  i=1:ON ERR GOTO 63455
63360  OPEN#6 AS INPUT,name$:OFF ERR:ON EOF#6 GOTO 63375
63365  INPUT#6;string$:IF LEN(string$)<=0 THEN 63365
63370  a%=INSTR(string$,blnk$,2):stmt$(i)=MID$(string$,2,a%-2):i=i+1:GOTO 6
       3365
63375  CLOSE:OPEN#6 AS INPUT,name$
63380  ON EOF#6 GOTO 63530
63385  lim=i-1:OPEN#7 AS OUTPUT,work$
63390  ON ERR GOTO 63425
63395  PRINT:INPUT"KEY STARTING STATEMENT & STEP: ";min,dif:OFF ERR
63400  a=min+lim*dif:IF min<1 OR dif<1 THEN 63420
63405  IF min-INT(min)>0 OR dif-INT(dif)>0 THEN 63420
63410  IF a>63999 THEN PRINT:PRINT"New Line #'s EXCEED Capacity Limit of 63
       999":GOTO 63390
63415  GOTO 63255
63420  PRINT:PRINT"POSITIVE Integers PLEASE!!":GOTO 63390
63425  PRINT:PRINT"Illegal Quantity":GOTO 63395
63430  :
63435  REM   ***  CLOSING ROUTINE  ***
63440  CLOSE:PRINT"DONE -- RENUMBERED ROUTINE INSERTED"
63445  EXEC".d2/renumworkfile":END
63450  DELETE".d2/renumworkfile":GOTO 63320
63455  PRINT:PRINT; TAB(10);"<<< Pathname "name$" does NOT Exist >>>":PRINT
       :INPUT"Press ANY Key FOR MENU";q$:GOTO 63620
63460  :
63465  REM  ***  CAPTURE ROUTINE AS TEXT FILE  ***
63470  n$=".d2/captureworkfile":ON ERR GOTO 63515
63475  CREATE n$, TEXT:OFF ERR:OPEN#8,n$
63480  s$=" 63505 list ":t$=" del "
63485  GOSUB 63860
63490  PRINT:PRINT"EXECUTE the Following TWO Statements in IMMEDIATE Mode"
63495  PRINT:PRINT;s$:PRINT" goto 63500":PRINT CHR$(11);CHR$(11);CHR$(11);:
       END
63500  OUTPUT#8
63505  LIST 63000 TO 63999
63510  OUTPUT#0:CLOSE#8:name$=n$:ON x GOTO 63355,63755,63840
63515  DELETE n$:GOTO 63470
63520  :
63525  REM   ***  CLOSING ROUTINE  ***
```

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List Routine. This can be done in unedited format as you would using the LIST command, or in edited format as the appended listing of PATCH illustrates. If many instructions are crammed into a single statement, you may have trouble getting wraparound on the printer, and difficulty reading the results when text and statement numbers appear in the same column position. The edited listing is obtained by capturing the program lines (asked for by PATCH) in a text file. They are then read back, edited and printed.

Capture Routine as Text File. Since this function is used as a subroutine for the other functions, I provided it as an option. I've used it for saving pieces of programs for editing as more general subroutines, or for saving information in DATA statements.

Extract, Renumber, Reinsert Routine. This is the principle function of PATCH. Input routines may be in a text file on disk or already resident in memory; the program asks you to specify. If the routine is in memory you are asked to identify the lines (they need not be contiguous groups of statements). You are then asked to specify the new starting statement number and the stepping constant. The routine is renumbered and placed in a text file, and the program asks whether you want to rename that file for later use. It then asks if you want to load the renumbered routine into memory. If the routine was taken from the program in memory, you are asked if you want to first delete the lines from which it derived. If you elect to load the routine, you stop at an END statement.

Reinitiate PATCH if you want the menu for more operations. (EXEC uses the console, so there is confusion when PRINT statements are performed while EXEC is doing its thing.) In the other cases you get back to the menu automatically.

Lines 63075–63455. These lines cover the subroutines for renumbering statements, including substituting the proper new numbers in GOTOs, GOSUBs, etc. Each new statement to be processed is picked up in line 63255. Each case requiring a new number is identified in lines 63265–63300. Other cases might be added (e.g., LIST). The processed statement is transferred to disk in line 63305. Setting up to do the renumbering is done in lines 63320–63455.

Lines 63465–63515. Here is where specified statements are captured as

Listing continued.

```
63530  CLOSE:PRINT:PRINT"Renumbered Routine is TEXT File with Pathname ";wo
       rk$
63535  PRINT:PRINT"Do you want to SAVE this Routine with a DIFFERENT Pathna
       me (Y/N)";:INPUT q$
63540  IF q$="y" THEN 63555
63545  PRINT:PRINT"Do you want to LOAD "work$" (Y/N)";:INPUT q$
63550  IF q$="y" THEN 63575:ELSE 63620
63555  PRINT:PRINT"Key NEW Pathname for ";work$;:INPUT newname$:ON ERR GOTO
        63570
63560  RENAME work$,newname$:OFF ERR
63565  SWAP work$,newname$:GOTO 63545
63570  PRINT:PRINT"   <<<  DUPLICATE or BAD Pathname - REPEAT  >>>":GOTO 63
       555
63575  ON jmp GOTO 63605,63580
63580  PRINT:PRINT"Do you want to DELETE the Captured Lines from Memory FIR
       ST (Y/N)";:INPUT q$
63585  IF q$="n" THEN 63605
63590  PRINT:PRINT"EXECUTE the Following TWO Statements in IMMEDIATE Mode"
63595  PRINT:PRINT;t$:PRINT" goto 63605":PRINT CHR$(11);CHR$(11);CHR$(11);:
       END
63600  DEL 1 TO 62999:REM Executed in IMMEDIATE Mode
63605  EXEC work$:END
63610  :
63615  REM  ***  DISPLAY MENU  ***
63620  HOME:VPOS=5:PRINT; TAB(15);"PATCH MENU"
63625  PRINT:PRINT"1. LIST ROUTINE (Unedited)"
63630  PRINT:PRINT"2. LIST ROUTINE (Edited)"
63635  PRINT:PRINT"3. CAPTURE (Save) ROUTINE as TEXT File"
63640  PRINT:PRINT"4. EXTRACT, RENUMBER, REINSERT ROUTINE"
63645  PRINT:PRINT"5. QUIT"
63650  PRINT:PRINT; TAB(10);"< MAKE SELECTION >";:INPUT s
63655  IF s=<0 THEN 63620
63660  PRINT:PRINT"Press <RETURN> to do TASK #"s"";:INPUT q$
63665  IF ASC(q$)<>-1 THEN 63620
63670  IF s=>5 THEN PRINT"BYE!":END
63675  ON s GOTO 63690,63745,63835,63320
63680  :
63685  REM  ***  LIST ROUTINES  ***
63690  PRINT:PRINT"ADJUST Printer and hit <RETURN>";:INPUT q$
63695  PRINT:PRINT"List WHOLE Program (Y/N)";:INPUT q$
63700  OPEN#3,".printer":IF q$="n" THEN 63710
63705  OUTPUT#3:LIST 1-62999:OUTPUT#0:GOTO 63620
63710  s$=" 63725  OUTPUT#3:LIST ":t$="":GOSUB 63860
63715  PRINT:PRINT"EXECUTE the Following TWO Statements in IMMEDIATE Mode"
63720  PRINT:PRINT;s$:PRINT" goto 63725":PRINT CHR$(11);CHR$(11);CHR$(11);:
63725  OUTPUT#3:LIST 1 TO 63999:REM Executed in IMMEDIATE Mode
63730  OUTPUT#0:CLOSE#3:GOTO 63620
63735  :
63740  REM  ***  EDITED LISTINGS  ***
63745  PRINT:PRINT"ADJUST Printer and hit <RETURN>";:INPUT q$
63750  OPEN#3,".printer":page=1:x=2:GOTO 63470:REM Go CAPTURE Routine
63755  OPEN#8 AS INPUT,".d2/captureworkfile":ff$=CHR$(12):line=0:bb=0:sp$=C
       HR$(32):bl$=sp$
63760  lf$=CHR$(10):cr$=CHR$(13):ON EOF#8 PRINT#3;lf$;cr$;:CLOSE:DELETE n$:
       GOTO 63620
63765  PRINT#3;cr$;bl$;" Page "page"";cr$;lf$;lf$;:page=page+1:line=line+2:
       bl$=sp$
63770  INPUT#8;string$:aa=INSTR(string$," ",2)+1
63775  IF LEN(string$)>75 THEN 63795
63780  PRINT#3;cr$;lf$; SPC(bb+1);string$;:IF line<54 THEN 63790
63785  line=0:bl$=ff$:bb=0:GOTO 63765
63790  line=line+1:bb=0:GOTO 63770
63795  FOR i=76 TO 65 STEP-1
         a$=MID$(string$,i,1):IF a$<>" " THEN 63810
         NEXT i
63810  PRINT#3;cr$;lf$; SPC(bb+1);LEFT$(string$,i);:line=line+1:bb=aa
63815  IF LEN(string$)-i=<0 THEN 63770
63820  string$=RIGHT$(string$,LEN(string$)-i):GOTO 63775
63825  :
63830  REM  ***  SAVE ROUTINE AS TEXT FILE  ***
63835  x=3:GOTO 63470:REM Go CAPTURE Routine
63840  PRINT:INPUT"Key PATHNAME for the ROUTINE";newname$:ON ERR GOTO 63570
        63845  RENAME n$,newname$:OFF ERR:GOTO 63620
63850  :
63855  REM  ***  LIST/DEL RANGE LIMITS  ***
63860  PRINT:PRINT"Key FIRST Line #  ";:INPUT l1
63865  PRINT"Key SECOND Line # ";:INPUT l2
63870  IF l1>l2 OR l1<0 OR l2>63999 THEN PRINT:PRINT"   <<<  ILLEGAL LINE #
       'S  -  REPEAT  >>>":GOTO 63860
63875  s$=s$+CONV$(l1)+" to "+CONV$(l2)+":":t$=t$+CONV$(l1)+" to "+CONV$(l2
       )+";"
63880  PRINT"Any more Sections to Pull Out (Y/N)";:INPUT q$
63885  IF q$="y" THEN s$=s$+"list ":t$=t$+"del ":GOTO 63860
63890  RETURN
```

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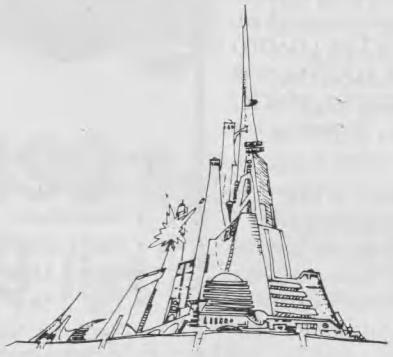

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OSI COLOR-80

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a text file. Line 63505 is created in line 63495 by printing it followed by a GOTO (to get back into PATCH again). You are instructed to execute the two lines from the console by running the retype key (right arrow) over them individually, hitting return each time.

Lines 63525–63605. Here are some miscellaneous subroutines used at the end of a renumbering exercise. Particularly note that line 63600, which deletes the lines extracted from the resident program, is set up on the console for execution in Immediate mode (as with line 63505, and again in line 63725).

Lines 63685–End. The listing options are managed here. The width of a printed line is controlled in line 63775; control of lines per page is in line 63780.

For accommodating smaller memories there are numerous ways to reduce the size of PATCH, an exercise I will leave to the interested programmer. Other functions might be added to this utility, such as compressing the number of line numbers or copying individual files from one disk to another.■

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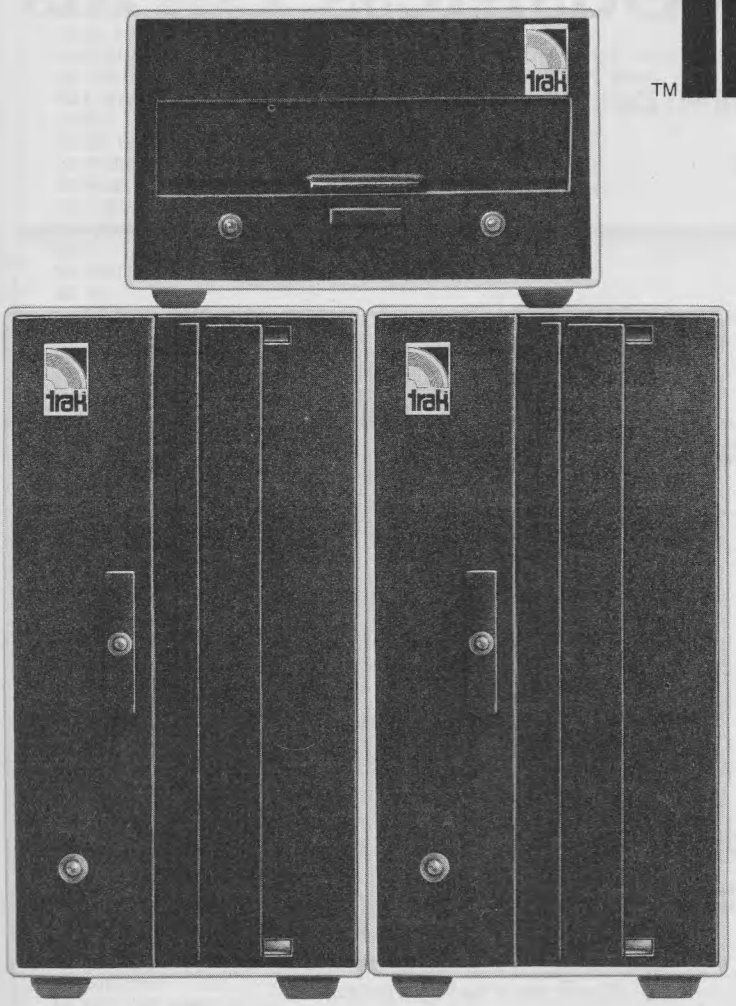

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With this H89 program that generates professional-looking order forms, all you have to do is sign the form and send it in.

Made-to-Order Business Forms

By Marilyn H. Deibert

Forms is designed to make a professional-looking order form, ready for mailing. Although the program is written for the Heath H-89, it can, with minor modifications, be used with any computer-printer combination. The screen graphics are used to enhance the input of data and can be deleted with no ill effects to the program.

The program has the following features:

- Entry of "ship to" address.
- If the "charge to" address is different than the "ship to" address, it can be entered.
- Entry of your invoice number.
- Entry of vendor name and address.
- Entry of various methods of payment (bank card, check, etc.).
- Entry of various types of shipping charge rates (flat rate, percentage of order or none).
- Entry of tax rate if applicable.
- Entry of specific method of shipment (UPS, Bestway, etc.).
- Error correction of entries prior to printing. Entries can be changed or additional entries can be made as an afterthought.
- Entry of 18 items to a form.
- Complete interaction between the user and the computer.

The question/answer format makes the program easy to use. After the printer has typed the form, you need only to sign it if a bank card is used, and then mail it.

Using the Program

To use the program, the only part of the run that may need clarification

Address correspondence to Marilyn H. Deibert, HQ DMMC 1 AD, APO, NY 09068.

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Sample run of the Forms program.

The Forms program listing, written for the Heath H-89.

```
100 REM ORDER FORM
110 REM******FORMS******
120 MARILYN H. DEIBERT
130 REM HQ DMMC 1 AD  APO NY 09068
140 REM 2 SEPT 1981
150 REM
160 L$=CHR$(10):REM LINE FEED
170 CLEAR500
180 REM
190 REM SETS EDITING
200 U$="#####.##":U1$="####":U2$="#####.###"
210 REM
220 REM  SETS GRAPHIC PARAMETERS
230 E$=CHR$(27):E1$=E$+"E":F$=E$+"F":G$=E$+"G":Y$=E$+"Y":J$=E$+"j":K$=E$+"k":L$=E$+"K":Y1$=E$+"Y"
240 REM
250 PRINTE1$:PRINTG$
260 PRINT"THIS PROGRAM WILL ALLOW THE ENTRY OF ITEMS FOR PRINTING OF PURCHASE ORDERS.";
270 PRINT" THE ENTRIES AVAILABLE ARE QUANTITY,  DESCRIPTION, PART NUMBER & UNIT COST."
280 PRINT:PRINT"THE EXTENDED PRICE WILL BE POSTED TO THE APPROPRIATE COLUMN ON THE CRT.";
```

More

Program listing continued.

```
290 PRINT" AFTER  ALL ENTRIES ARE ENTERED, VERIFY THEIR ACCURACY AND MAKE ANY NECESSARY          C
ORRECTIONS."
300 PRINT:PRINT"WHEN YOU HAVE COMPLETED ALL ENTRIES, ENTER A '0' WHEN THE QUANTITY IS REQUESTED.";
310 PRINT"THEN MAKE THE PRINTER READY AND THE INFORMATION WILL BE PRINTED FOR YOU."
320 PRINT:PRINT:INPUT"PRESS 'RETURN' TO CONTINUE.";Q$
330 PRINTE1$
340 DIMA(20,3),A$(20,2)
350 REM INPUT ADDRESS DATA
360 REM
370 INPUT"TODAY'S DATE (MM/DD/YY) ";Y4$:PRINT
380 INPUT"SHIP TO NAME";N$
390 PRINT:INPUT"STREET ADDRESS";S$
400 PRINT:LINEINPUT"CITY STATE ZIP CODE ";Z$
410 PRINT:INPUT"ENTER YOUR PHONE # (999-999-9999) ";PA$
420 PRINT:INPUT"ENTER YOUR INVOICE NUMBER ";I$
430 REM PAYEE DIFFERENT FROM SHIP TO
440 PRINT:INPUT"IS THE PAYEE NAME & ADDRESS THE SAME AS THE SHIP TO (Y/N) ";Q$:IFQ$="Y"THEN490:PRINT
450 IFQ$="N"THENPRINT: INPUT"PAYEE NAME ";P7$:PRINT:INPUT"PAYEE STREET ADDRESS ";P8$:PRINT
460 LINEINPUT"PAYEE CITY STATE ZIP CODE ";P9$
470 REM
480 REM INPUT VENDOR ADDRESS
490 PRINT:PRINT:PRINT:INPUT"VENDOR NAME";N1$
500 PRINT:INPUT"VENDOR STREET ADDRESS";S1$
510 PRINT:LINEINPUT"VENDOR CITY STATE ZIP CODE ";Z1$
520 PRINT:INPUT"MODE OF SHIPMENT (UPS,BEST WAY ETC.)";M$
530 REM
540 PRINTE1$
550 REM
560 REM ALLOWS SELECTION OF PAYMENT
570 REM
580 PRINT:INPUT"METHOD OF PAYMENT (M.O.,CHECK, CARD C.O.D)";P$
590 IF P$="CARD"THEN PRINT:INPUT"WHAT TYPE CARD (VISA,MASTER CHG, ETC.)";P1$
600 IFP$="CARD" THEN PRINT: INPUT"WHAT IS YOUR CARD NUMBER ";P2$
610 PRINT:IFP$="CARD"THEN INPUT"EXPIRATION DATE (MM/YY) ";M2$
620 REM
630 REM SETS TABLE SIZE
650 REM
660 PRINTY1$:PRINTG$:REM  CLEARS GRAPHICS
670 REM
680 PRINTE1$ :  REM CLEARS SCREEN
690 REM SETS UP CRT FOR INPUT
700 PRINT" QTY";TAB(12);"PART #";TAB(28);"DESCRIPTION";TAB(49);"U/C";TAB(59);"E/C"
710 PRINTF$;
720 REM
730 REM BUILDS FORM ON CRT
740 PRINT"faaaaasaaaaaaaaaaaaaasaaaaaaaaaaaaaaaaaaaaaaasaaaaaaaaaasaaaaaaaac"
750 FORX=1TO18
760 PRINT"^";TAB(6);"^";TAB(21) ;"^";TAB(45);"^";TAB(56);"^";TAB(66);"^"
770 NEXTX
780 PRINT"eaaaaauaaaaaaaaaaaaaauaaaaaaaaaaaaaaaaaaaaaauaaaaaaaaaauaaaaaaaaad"
790 FORX=1TO18
800 PRINTJ$;
810 REM
820 REM POSITIONS CURSOR FOR PRINTING
830 REM
840 INPUT"ENTER QUANTITY  ('0' IF DONE)";A
850 IF A=0 THEN 1060 ELSE 860
860 A(X,1)=A
870 PRINTY$;CHR$(34+X);CHR$(33);USINGU1$;A(X,1)
880 PRINTK$;L$;
890 INPUT"PART NUMBER";A$(X,1)
900 PRINTY$;CHR$(34+X);CHR$(39);A$(X,1)
910 PRINTK$;L$;
920 INPUT"DESCRIPTION";A$(X,2)
930 PRINTY$;CHR$(34+X);CHR$(54);A$(X,2)
940 PRINTK$;L$;
950 INPUT"ENTER UNIT COST";A(X,2)
960 A(X,3)=A(X,1)*A(X,2)
970 PRINTY$;CHR$(34+X);CHR$(78);USINGU2$;A(X,2):PRINTK$;L$;:PRINTY$;CHR$(34+X);CHR$(89);USINGU$;A(X,
3):PRINTK$;L$;
980 REM COUNTER FOR NUMBER OF ENTRIES
990 CR=CR+1
1000 IFCR=18 THENPRINT"THERE IS A LIMIT OF 18 ITEMS PER ORDER.":INPUT"PRESS RETURN TO CONTINUE.";Q$
1010 NEXTX
1020 PRINTG$
1030 REM
1040 REM SHIPPING AND HANDLING ROUTINE
1050 REM
1060 FORX=1TOCR:A4=A4+A(X,3):NEXTX:GOSUB1700:REM TOTAL OF ORDER
1070 PRINTE1$:PRINT"TOTAL OF ORDER";TAB(20);USINGU$;A4
1075 PRINT:INPUT"DO YOU WANT TO MAKE A COMMENT ON THE ORDER FORM (Y/N)";R$:IFR$="Y"THENGOSUB2000
1077 IF R$="N" THEN R$=" "
1080 PRINT:INPUT"SHIPPING/INSURANCE CHARGE (F=FLAT RATE, P=% OF ORDER, N=NONE)";C2$
1090 REMSETS UP SHIPPING/HANDLING AND TAXES
1100 IFC2$="N"THEN1140
1110 IFC2$="F"THEN1120ELSE1130
```

More →

is the error correction routine. After all data has been initially entered, a summary of the order will be displayed. At this time the entries may be corrected, added to or left as they are for printing. There are three choices for the user—OK to indicate that all is correct, C to indicate that a change is needed or A to indicate that another entry is needed.

If C is entered, the line for correction is requested. After entering the line number, the question QUANTITY will appear. If the quantity is to be changed, enter the change; otherwise, press enter and the PART # question will appear. Again, if it is alright, enter a return or enter the correct information. All other line entries are similar—if it is OK, press return or enter corrected data.

If you wish to delete a line of data, again enter the line number. On each question, enter a space and then a return. The space will take the place of the deleted item and will not be printed on the printer, but will show on the CRT as zeroes for entries to show that a line has been deleted.

The program will accept 18 entries. This number is determined by the screen size and the way the data is entered. Line number 790 sets this limit for the CRT and line 1470 sets the page size for the printer (22 lines in this case).

The program lets you add up to 255 characters for comments to order forms. It is available from the author for $5. Include a formatted H-89 disk.■

Program listing continued.

```
1120 PRINT:INPUT"FLAT RATE";C2:GOTO1140
1130 PRINT:INPUT"PERCENTAGE";C2:C2=C2*A4
1140 PRINT:INPUT"ENTER TAX RATE (.05=5%) IF APPLICABLE";A6
1150 A5=A4*A6:REM COMPUTES TAX
1160 REM
1170 PRINT E$+"z":REM SETS ALL PARAMETERS BACK TO NORMAL
1180 REM
1190 REM PRINT ROUTINE FOR PRINTER
1200 REM
1210 PRINTE1$:INPUT"IS THE PRINTER READY? PRESS RETURN WHEN READY.";W$
1215 IFW$<>"Y"THEN1210
1220 REM OPENS LINE PRINTER FILE
1230 OPEN "O",1,"LP:"
1240 PRINT#1,E$;CHR$(30)
1250 PRINT#1,TAB(50);"DATE ";Y4$
1260 PRINT#1,N1$
1270 PRINT#1,S1$
1280 PRINT#1,Z1$;:PRINT#1,TAB(90);"INVOICE # ";I$
1290 FORX=1TO5:PRINT#1,L$:NEXTX
1300 PRINT#1,"CHARGE TO   ";P7$;TAB(44);"SHIP TO  ";N$;TAB(90);"PHONE NO. ";PA$
1310 PRINT#1,TAB(12);P8$;TAB(53);S$
1320 PRINT#1,TAB(12);P9$;TAB(53);Z$
1330 PRINT#1,L$:PRINT#1,L$:FORX=1TO120:PRINT#1,"-";:NEXTX
1340 PRINT#1,L$
1350 PRINT#1,"SHIPPED";TAB(12);"QTY";TAB(25);"PART #";TAB(55);"DESCRIPTION";TAB(89);"U/C";TAB(101);"
E/C";TAB(110);"REMARKS"
1360 FORX=1TO120:PRINT#1,"-";:NEXTX
1370 PRINT#1,L$
1380 FORX=1TOCR
1390 IFA(X,1)=0 THEN 1460 :REM DON'T PRINT DELETED ITEM
1400 REM PRINTING DATA ON FORM
1410 PRINT#1,TAB(12);USINGU1$;A(X,1);
1420 PRINT#1,TAB(26);A$(X,1);TAB(56);A$(X,2);
1430 PRINT#1,TAB(85);USINGU2$;A(X,2);
1440 PRINT#1,TAB(98);USINGU$;A(X,3)
1450 H=H+1
1460 NEXTX
1470 A9=22-H
1475 PRINT#1,L$,L$:PRINT#1,R$
1480 FORX=1TOA9:PRINT#1,L$:NEXTX
1490 PRINT#1,L$:FORX=1TO120:PRINT#1,"-";:NEXTX
1500 PRINT#1,L$
1510 PRINT#1,"SHIP VIA ";M$;
1520 PRINT#1,TAB(90);"TOTAL";TAB(98);USINGU$;A4
1530 IFA5<>0 THENPRINT#1,TAB(90);"TAX";TAB(98);USINGU$;A5
1540 PRINT#1,"METHOD OF PAYMENT ";P$;
1550 PRINT#1,TAB(80);"SHIPPING/HANDLING";TAB(98);USINGU$;C2
1560 C3=A4+C2+A5    :REM C3=TOTAL OF ORDER, A4=AMOUNT OF ORDER, C2=SHIP/HAND, A5=TAX
1570 PRINT#1,TAB(80);"TOTAL OF ORDER";TAB(98);USINGU$;C3
1580 IFP$="CARD" THEN PRINT#1,P1$;" CARD # ";P2$:PRINT#1,"EXPIRATION DATE ";M2$
1590 PRINT#1,L$ :PRINT#1,"SIGNATURE.............................."
1600 REM
1610 PRINT#1,CHR$(12):REM   TOP OF NEW PAGE
1620 CLOSE#1:A4=0
1630 REM
1640 INPUT"DO YOU WANT TO MAKE ANOTHER ORDER (Y/N) ";Q$:IFQ$="Y"THEN1650 ELSE 1660
1650 C2=0:A6=0:ERASE A:ERASEA$:GOTO330
1660 END
1670 REM
1680 REM SUMMARIZES ORDER FOR ACCURACY CHECK AND ERROR CORRECTION
1690 REM
1700 PRINTE1$:PRINT"HERE IS A SUMMARY OR YOUR ORDER. IF THEIR IS AN ERROR, CORRECT IT NOW."
1710 PRINT
1720 PRINT"LINE/NO","QTY","PRT/NO";TAB(50);"DESC";TAB(68);"UNIT PRICE"
1730 FORX=1TO80:PRINT"-";:NEXTX
1735 FORX=1TOCR:IFA(X,2)=0 THEN1745
1740 PRINTX,A(X,1),A$(X,1),A$(X,2);TAB(70);USINGU2$;A(X,2)
1745 NEXTX
1750 PRINT:PRINT"EXTENDED TOTAL OF ORDER $";USINGU$;A4
1760 PRINT:INPUT"OK=ALL ENTRIES CORRECT, C=MAKE CORRECTIONS, A=ADD ENTRIES";X1$
1770 PRINT:IFX1$="OK"THENGOTO1870
1780 IFX1$="C"THENPRINT"TO DELETE A LINE, ENTER '0' IN ALL FIELDS ELSE ENTER CORRECT DATA":GOTO1800
1790 IFX1$="A"THENCR=CR+1
1800 PRINT:INPUT"LINE NUMBER";X
1810 IFX1$="A" AND X<CR THENPRINT:PRINT"INCORRECT LINE # FOR ADDITION.NEXT LINE IS # ";CR:GOTO1800
1820 IFX>CR THEN PRINT"YOU DON'T HAVE THAT MANY LINES!":GOTO1800
1830 INPUT"QUANTITY ";A(X,1):INPUT"PART # ";A$(X,1):INPUT"DESCRIPTION ";A$(X,2):INPUT"UNIT COST ";A(
X,2)
1840 A(X,3)=A(X,1)*A(X,2)
1850 A4=0:FORX=1TOCR:A4=A4+A(X,3):NEXTX
1860 GOTO1700
1870 RETURN
2000 PRINTE1$:INPUT"ENTER YOUR COMMENTS--LIMIT 255 CHARACTERS.";R$
2010 RETURN
```

↙See List of Advertisers on page 210

Off to a cautious start, the U.S. must plan some bold moves to compete in the videotext market.

Around the World With Videotext

By Henry and Elizabeth Urrows

Much talent is at work developing computer-based communications systems that use television, the telephone or cable. Most of the inventions originated in England, France, Canada and Japan. We, in the U.S., cautiously adapt what is emerging elsewhere for our massive yet hard-to-predict markets.

We are now in an era of videotext concept trials and market tests, gingerly introducing what others began a decade ago. Our private enterprise economy inhibits risky, costly experiment. Countries which have government-financed enterprises and national post and telegraph authorities (PTTs) are bolder than our corporations, whose officers are afraid of letting their bottom lines sag.

Videotext studies are a fascinating small industry in themselves. The only *happenings* in their variegated terrain of pilots, models and trials are the one-way Ceefax and Oracle teletext systems in England, the British Telecom two-way Prestel viewdata system, Prestel International in eight countries and the Finnish commercial Telset in Helsinki. You can add the Dutch TVS in Amsterdam that began in 1980, and for perspective include the Dow Jones News/Retrieval Service, CompuServe and The Source. After these, all the rest are tests.

Telidon travel guide introduces two sets of pages. (See taxi photo on page 88.) (Courtesy of Infomart.)

Swiss Trial

One of the smallest two-way viewdata trials has been going on in Switzerland since November 1979. It began as a 16-port system, using Prestel software. An interesting feature of the system is its ability to use either German or French. After accessing the system, the user chooses which language will be used for that session. (All error messages are bilingual.)

Because of a shortage of terminals, the Swiss PTT began the trial with very few users. By March 1980 there were 70 business subscribers and 20 PTT departments using 32 ports. In July memory space increased from 4.8M bytes (4000 pages of information) to 70M bytes (60,000 pages). By March 1981 there were 86 subscribing organizations and 100 members of the Swiss Viewdata Information Providers Association (SVIPA) looking toward a test service in 1983 with 2000 subscribers.

The Swiss trial is pertinent to the U.S. because it addressed the question of whether the PTT should limit its role to *transport* of information

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(i.e., service as a common carrier) or also offer storage capacity to information providers. (As long as the Bell System's functions are being defined by the U.S. Congress, the Federal Communications Commission and the courts, it is hard to tell whether AT&T will be only a manufacturer of Western Electric videotext terminals, a network, a publisher of electronic yellow pages or some combination of these.) The SVIPA strongly opposes the PTT offering even limited storage space to information providers, especially to small ones who cannot afford their own external databases and do not want to depend on private umbrella information providers. SVIPA is afraid the PTT would sell storage at lower prices than private database owners.

Standard Telephone and Radio AG (STR) technical director Peter A. Gfeller and data systems manager Pierre E. Schmid have written that "one point of particular sensitivity and interest" is how Canada's advanced Telidon alphageometric graphics "could be introduced in the alphamosaic European world." STR proposed that every terminal have minimal alphamosaic capability. The videotext center is to be transparent for all other formats. They foresee multiple-mode terminals that will be able to switch between alphamosaic and alphageometric modes. Such a terminal should resemble those implicit in the AT&T Presentation Level Protocol standard (see "Setting the Standards for the Industry," *Microcomputing*, Oct. 1981, page 77).

Switzerland's July 1980 specifications for the trial envisioned:

- three transparent videotext centers interconnected via the Swiss data network TELEPAC
- information retrieval through the Public Switched Telephone Network (PSTN) and the videotext center
- information input directly to databases either through PSTN or TELEPAC
- data collection provisions
- a message service
- closed user groups
- three languages
- separate subscriber modems
- and a *gateway* function to external databases.

Gateway and Bildschirmtext

The Deutsche Bundespost has said it will introduce its Bildschirmtext viewdata service across West Germany in 1983. Duesseldorf and Berlin field trials have been in progress with 6000 terminals since June 1980. The genius of Bildschirmtext (Btx) is that, using enhanced Prestel hardware and software, videotext centers serve as a network giving users access to third-party host-computer databases. Banks, publishers, stores, travel firms, etc., can use their computers via Btx to facilitate electronic funds transfer, for remote ordering of goods and services and for real-time updating of databases.

> The benefit of viewdata has not been to save money or time for Whitbread, but to overcome the resistance which many people in industry seem to have to the use of computers.

Heinzfred Mantel, data communications systems development chief of Standard Electrik Lorenz AG (SEL), has described a Seltext center designed to serve approximately 80,000 subscribers. It stores 100,000 frames of information in its basic configuration and can be enlarged to store up to 2 million pages. Gateway service subscribers and information providers communicate with the center by public telephone and the network of videotext centers.

In sales parlance, Gateway is hot. British Telecom has licensed it from the Bundespost and promises to offer Gateway service on Prestel while its Canadian competitors say they can in time deliver Gateway with Telidon. At the Videotext '81 conference at Toronto last May, Alan R. Haimes, information systems divisional manager of Systems Designers Ltd. in Surrey, explained how Gateway enables private viewdata systems to seize advantage of both public and private services.

Private viewdata systems that do not furnish their own networks and that have numerous remote locations incur large telephone toll charges. With Gateway, however, a private viewdata system can use a public service for local-call access to a local viewdata center.

"This arrangement," according to Haimes, "leaves the third party (i.e., private) database operator free to provide any of the services his company requires or indeed that the marketplace will buy."

The Gateway facility eliminates the practical problems of large remote data-storage costs, slowed response times, and unfriendly preliminaries required to establish network user identity, password and network address of the host computer. By simply selecting the Gateway page of an external computer, the terminal user connects with it.

West German organizations seeking to make Gateway connections over the last two years have been forced, Haimes said, to develop their own software. Others now have the benefit of their pioneering. This can make Gateway service cheaper, faster and more reliable.

Prestel, Ceefax, Oracle

Richard Hooper, director of Prestel for British Telecom, says that there will be full Gateway service on Prestel in early 1982. And that 120 organizations are queued up to use it.

In Britain 14 private viewdata systems are in operation. TOPIC (Teletext Output of Price Information by Computer), operated by the London Stock Exchange since June 1980, can connect 1000 terminals to each Modcomp Classic 7870 computer without exceeding the maximum tolerated response time of one second, and can handle a peak of 200 page-requests per second on each machine. Orders will bring the total number of terminals to 1300 by April 1982. Designed for flexibility, TOPIC can serve closed user groups, connect to remote country locations by public networks, use Gateway to view client portfolio data and to access Ceefax, Oracle and Prestel.

One private system unlikely ever to want Gateway is Whitbread breweries' DAISY (Daily Information System), which consolidates data on customers' orders coming from five regional computers into easy-to-read-at-a-glance colored graphic produc-

tion charts. The benefit of viewdata has not been to save money or time for Whitbread, but to overcome the resistance which many people in industry seem to have to the use of computers, Sam Fedida and Rex Malik have written.

Among Prestel enhancements are high-resolution graphics, single color dynamic redefinable character sets (DRCS) succeeded by multicolor, multilanguage text, smoothline graphics, ranges of pastel colors and color borders, data encryption for users' security and the new PANDA (Prestel Advanced Network and Database Architecture) network. This means Gateway with messages and access to third party databases, tailored insurance quotations and mortgage calculations, real-time service on airline and hotel reservations, high volume data capture for transactions such as mail orders, very large specialized scientific and bibliographic databases, printers and associated equipment. There is also Picture Prestel, demonstrated at Viewdata '80 by DPCM (Differential Pulse Code Modulation) but due to be introduced in London as the first phase of an integrated services digital network.

Britain's Ceefax and Oracle teletext systems have earned sufficient user acceptance to assure their continuation. Ceefax is paid for by the license fee every TV set owner or renter must pay according to British law. Ceefax has taken less than $1 million in capital investment and no more than $500,000 in annual operating costs. The IBA is a profitable commercial TV enterprise that makes enough profit to afford Oracle as a public service. Because teletext can also be an advertising medium, what public service CBS, NBC and Westinghouse contribute will be incidental to their profit-making functions.

The British Post Office has already invested more than $48 million in Prestel. Equipment and microchip manufacturers had put in an estimated $24 million, and over 200 information providers at least $7.2 million.

British Telecom, split off from the Post Office by an act of Parliament, is not yet making money from Prestel. The worst depression in England since the 1930s is a central factor, and may well explain why seven out of eight subscribers are business users able to charge their decoders and fees as company expenses. The assumption that entrepreneurs in the U.S. are making is that videotext is a mass residential market along with broadcast and cable TV.

Prestel can be useful when it lets users avoid lines at banks and travel agencies when ordering travelers checks, booking airline space, getting theater and train seats and finding updated information quickly and conveniently. Too many persons in service occupations there (and in the U.S., too) hate their jobs. Some bureaucrats in government, business, and institutions waste time telling you at length why they can't help you. For consumers who would just as soon have competent comparison shopping done for them, who seek apartments or job openings that are too often taken before newspapers advertising them hit the street, for executive searchers hunting exactly the right candidate with minimum rigmarole—viewdata can work.

Prestel can be useful when it lets users avoid lines at banks and travel agencies when ordering checks, booking airline space, getting theater and train seats and finding updated information quickly and conveniently.

Antiope

CBS petitioned the FCC on July 29, 1980 to adopt a teletext standard

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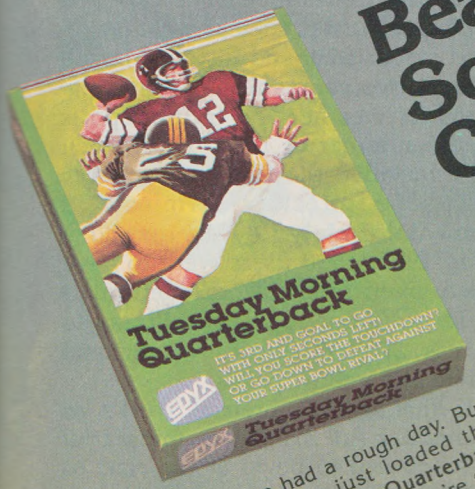

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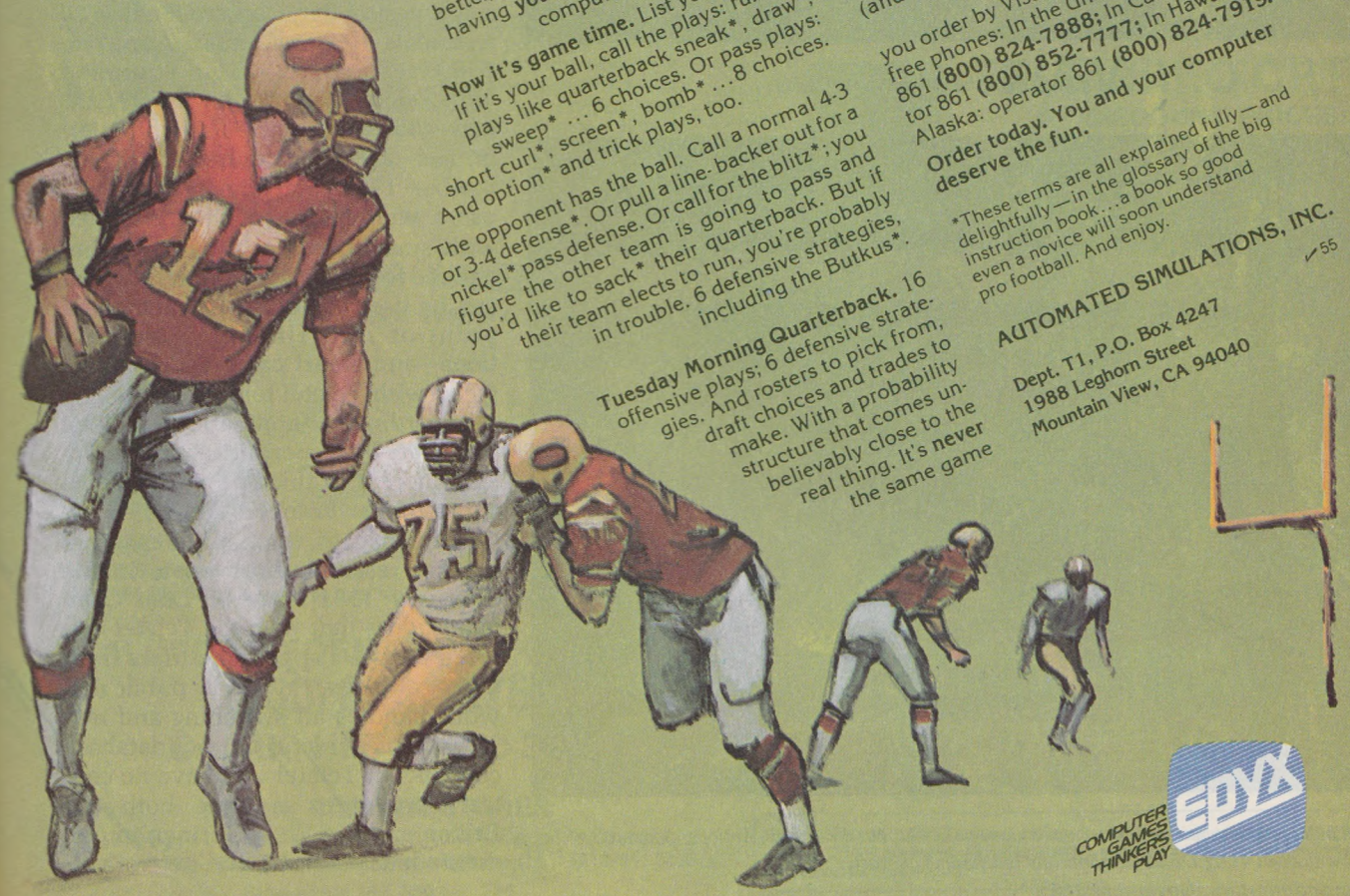

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based on the French Antiope (Acquisition Numerique et Televisualisation d'Images Organisees en Pages d'Ecriture) system. Antiope has a variable or asynchronous format, unlike the British Ceefax, Oracle and Prestel, which have a synchronous or fixed format. In the British system the position of data on the TV scanning line directly relates to the position of the display on the TV screen. With Antiope, there is no relationship between the data on the TV scanning line and its location on the screen.

CBS's supporting engineering statement said each of the two systems has advantages and disadvantages, based on fixed format tests made at KMOX-TV St. Louis and variable format transmissions over KNXT-TV Los Angeles. CBS technical people chose the latter in the belief the variable format can more easily adapt to changing technology.

France's one broadcasting company, Telediffusion de France (TDF), has broadcast a stock teletext service in partnership with the French Stock Exchange Committee since 1977 and an experimental teletext weather report since 1979, and installed terminals at two companies' gasoline stations for weather and traffic reports in the summer of 1980. The French PTT installed the first 50 electronic telephone directory terminals at Saint Malo in July 1980. By the end of May 1981, 1500 users were to have been given free videotext terminals in Ile et Vilaine in western France to access 270,000 entries of regional white and yellow pages.

If this second pretrial works as planned, a full 270,000-terminal trial is scheduled to begin at the start of 1982, looking toward a national electronic telephone directory serving 30 million customers by 1992. The French PTT believes it will cost less to give away terminals on that scale than to continue printing telephone books, which now cost about $230 million a year.

Looking toward national acceptance of Teletel, the two-way viewdata system based on Antiope, nearly 170 business and government organizations have contracted to furnish database material for a trial in Velizy, southwest of Paris, where the first 20 terminals were placed in April and 2500 residences—2100 equipped with Teletel adapters to color TV sets and 400 with black-and-white terminals—are to be connected by September 1981. Starting in June, 300 users were to have been supplied with smart cards—plastic cards embedded with microcomputers which can be used for up to 100 home and point-of-sale financial transactions—and smart card readers interfaced with Teletel terminals.

According to Intelmatique, Teletel has Gateway, permitting users instant access to third-party databases throughout France. And Lee R. Greenhouse of the Link Resources market research firm wrote in the February 1981 issue of *Data Communications* that with the Teletel network France's approach differs from other countries "in that its public network handles all switching and network management, but not database control. . . . Teletel will have no central computer, as have both the British and the West German implementations. Instead, the network it-

"On the move" from the Telidon travel guide.

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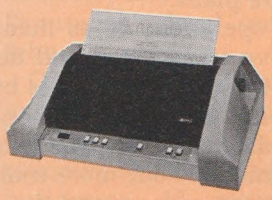

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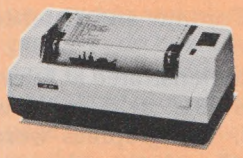

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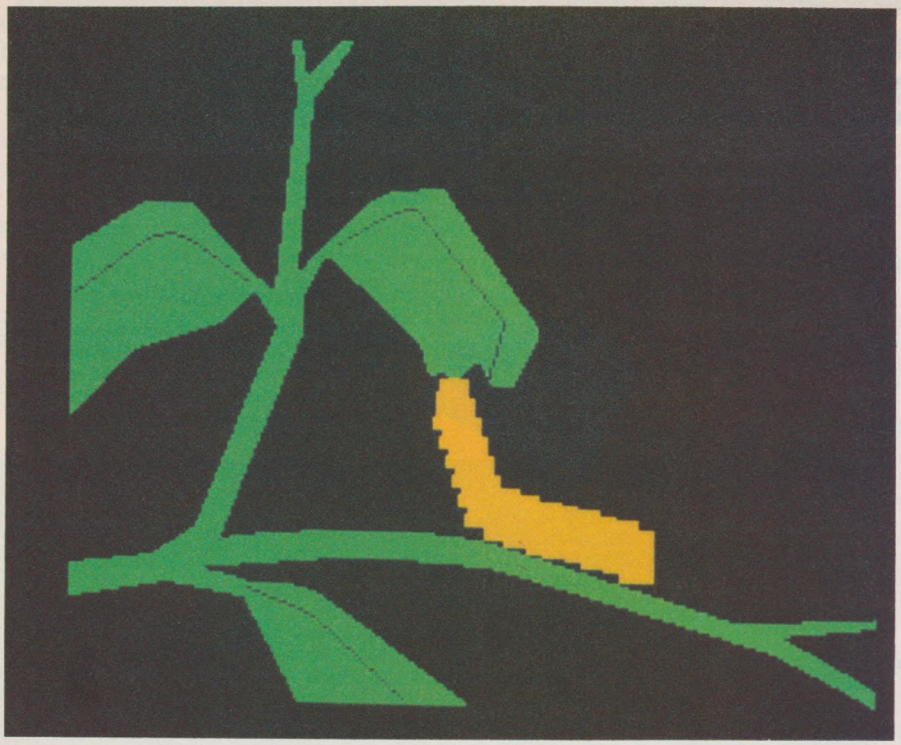


Animated Telidon sequence that shows a caterpillar eating a leaf and turning into the butterfly. (Andrej Teene-Sens, informatics technical adviser to the Canadian federal Department of Communications, believes these kinds of animation are possible only in alphageometric teletext and viewdata systems.)

self will do all switching, connecting users with the appropriate hosts, which are maintained by the information providers and contain the interface software."

France plans to invest $27 billion during the next five years to become the "Charlemagne of the wired nations" and a major source of communications technology, having set an initial objective of exporting 30 percent of its telecommunications equipment by 1982. France has thus far been bolder than Britain in selling. To help bring the cost of terminals down, the French PTT itself ordered 300,000 from four manufacturers in May 1981, and Tymshare of Cupertino, California has ordered 100,000 personal computer terminals from the French manufacturer Matra. TDF has loaned Antiope teletext equipment—page generation, captioning gear and the patented Didon transmission system—that cost more than $1 million for the Los Angeles trial by CBS of its Extravision teletext over the CBS TV station KNXT and by PBS station KCET of its teletext magazine NOW. On-air service began in April 1981 to less than a score of terminals in public places, looking toward 100 more decoders being in homes by end of summer. French promoters are unafraid to prime their pumping of U.S. markets with competitive selling zest.

Antiope Videotex Systems, Inc. sent Claude Sechet to speak at IEEE in Chicago in June 1980 on Antiope teletext captioning. The Didon system is transparent in accepting any kind of digital signal without altering it in any way. Sechet said the Antiope variable asynchronous format permits placing the caption anywhere on the screen, using the same decoder for captions and teletext and DRCS for symbols. Prototypes were testing the validity of these services when he gave his paper.

General Manager Marcel Berger of Sofratev and chief engineer Y. Noirel of TDF's CCETT data broadcast procedures lab described DIODE (Diffusion d'Information Obtenu par Demande), the data retrieval system that uses entire TV channels to transmit nothing but data, at Toronto in May 1981. They said six magazines with about 600 pages using about 60 lines per field were being broadcast over a specialized network employing only one-fifth of one channel's capacity. Sofratev and CCETT plan to put into operation a 20-channel videodata multiplexer this year. They are also studying a three-channel videodata multiplexer that will be fully microcomputer-programmed to assign each field the number of lines needed for transmission of the data present in the buffers assigned to each digital channel. They call this dynamic allocation and say that "to make the best use of the possibilities offered by the asynchronous system will certainly take a while to finalize." DIODE combines a high data rate and wide coverage. It points a way to solve the problem of congested interactive networks.

Telidon

Canada's videotext salesmanship has such a high energy level and is so vigorously resourceful that it isn't easy to separate achievements from dazzling future plans.

Four pilot operations in as many provinces have transmitted and decoded many thousands of frames by satellite, on-air broadcasts, phone wires and dedicated cable pairs to at least 125 terminals. Four more trials with government money, and three using corporate and utility capital, have begun or are scheduled. Canada began a four-year encouragement program committing $10 million in 1979. This was increased by $27.5 million in 1981, when Bell Canada said it will invest $8.5 million in trials being held in Toronto and Quebec City.

Telidon was demonstrated at Information Utilities '81, held in New York this April. The graphics were beautiful, even though the salesmen at the exhibit tended to use selective truths that didn't withstand careful scrutiny.

We were captivated, though, by the best organized and most incisive oral presentation of videotext we had ever heard, given by Larry Pfister, sales vice-president for the Telidon Videotex Systems, Inc. for Infomart, the Canadian electronic publisher and vendor of turnkey systems.

Pfister was low-key, yet exuded strong confidence when he reported that Time, Inc. will use Telidon for its late 1981 teletext test on one of the cable systems owned by its American Television & Communications Corporation (ATC) subsidiary, and that the Times Mirror has said it will buy a 200-terminal field trial setup operating simultaneously over telephone and two-way cable networks in Los Angeles and Orange counties in California, also in late 1981.

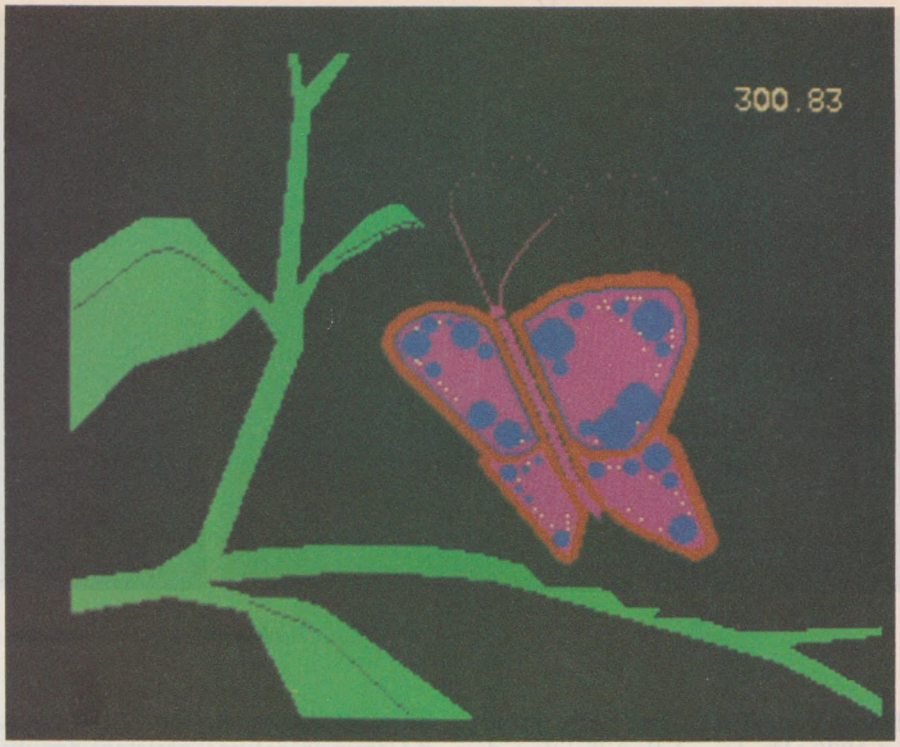
Canada is jumping with trials and announcements of more to come. Since January 1980 the Ontario Educational Communications Authority has sent teletext pages to 55 terminals, some of them in a remote northern town reached by the ANIK-B satellite.

Since May 1980 the Manitoba Telephone System has connected 100 homes in South Headingley with coaxial cable (providing residents with digital telephone, answering and message service, telemonitoring for fire alarms, etc.) of which 30 are trying out Telidon terminals.

In late April 1981 the New Brunswick Telephone Company began rotating 45 Telidon terminals among 75 homes, businesses, and such institutions as the community college, public library and the University of New Brunswick's local campus in Saint John.

On May 20 Bell Canada kicked off its Telidon trial in Toronto and Quebec City, initially with 491 terminals, rationing half to homes, one-fourth to businesses, 15 percent to public places and 10 percent to educational users. Dubbed VISTA, it is not charging users or information providers.

In early May the Manitoba Telephone Co. installed 25 Telidon terminals in offices of grain elevator operators, crop-insurance agents, agriculture agents and places where farmers gather to do business in the southern part of the province. Two dozen information providers pay a dollar per page per month to furnish data on market prices, feed costs, grain futures and other variables that affect agribusiness. This Project Grassroots network will expand in the fall with some of the 150 terminals planned for the Elie-St. Eustache area testing Telidon transmission over optical fiber and there's expectation of expansion to break even—providing terminals and service at less than $60 per month before the end of 1982.



The butterfly from the animated Telidon sequence.

The Alberta Government Telephone utility is not forthcoming about just when its mid-1981 test network begins. Instead of using 120 terminals as planned, it's reported to be "bicycling" 30 sets among 120 locations.

British Columbia Telephone Co.'s videotext project market research supervisor says its 125 receivers will cost about $3000 each and should be in use this coming September and October in a trial budgeted at $3 million.

Projecting future terminal prices is something of an arcane art. Roger Woolfe of Butler, Cox & Partners, the

✓See List of Advertisers on page 210

The four photos on these two pages represent the four seasons sequence in the CAPTAIN

British consulting firm, made a study in 1980. He found that Telidon decoders with TV monitors cost $1450 in Canadian dollars, compared with Prestel decoders at $1120. When production quantities reach 100,000 a year, Woolfe said the Telidon units should drop to $290.

Electrohome, one of four Canadian terminal makers, thinks it will produce over 1000 business terminals with color TV monitors in 1981 at $3876. When sales pass 50,000 a year in 1983, Electrohome says it "will be manufacturing a complete home consumer package with monitor, standard television capability, modem, teletext receiver, decoder and possibly keyboard capability, for $1100."

In the offing are a 150-terminal network of Canadian federal government departments connected by the DATAPAK network; 250 terminals tied into the Montreal Telecable Videotron test in early 1982; a two-city Cablecom of Saskatchewan "trial for later in 1981"; a Maritime Telephone & Telegraph Co. field trial in Nova Scotia in 1982; and the Canadian Broadcasting Corp.'s nationwide Telidon trial service forecast for the summer of 1982, at a projected cost of $6 million.

At the heart of Telidon are picture description instructions (PDIs) that encode and store basic geometric building blocks—point, line, rectangle, arc and polygon (polygons can have a maximum of 200 sides in present software)—with a range of options as to their location on the TV screen, size, color, luminance and other attributes. As the Department of Communications' assistant deputy minister for research, Douglas Parkhill, phrased it at the Inside Videotex seminar in March 1980: "All we do is to store in the database coordinates of the end points of the line and the computer instruction that says, 'Draw the shortest line between these two points'. . . . The storage capacity (versus the older method) is enormously reduced. It would take several hundred characters to store the line as mosaics. . . . In our system, it takes only five or six characters. So the secret of Telidon is. . . that any known picture can be represented by a finite number, and in fact a very small number of what we call 'picture primitives' or 'picture description instructions.' "

There are two assumptions behind anticipations that Telidon will be economically feasible. First is the expectation that the component cost will go steadily down. Second is that the costs of the users' decoders will be covered by capital from advertising.

Telidon must enhance its decoders to suit more advanced computer graphics in the AT&T videotex standard. After it does so, there may be a fresh irony when these, too, prove obsolete in the light of Japanese improved alphaphotographic videotext coding.

CAPTAIN

We wish we could see more of the CAPTAIN (Character and Pattern Telephone Access Information Network) system as it unfolds during premarket and market trials into full commercial service in 1983.

Although DRCS can reproduce all manner of symbols in enhanced editing and decoding terminals in the West, Japan started with 4000 different text characters—alphanumeric and special symbols.

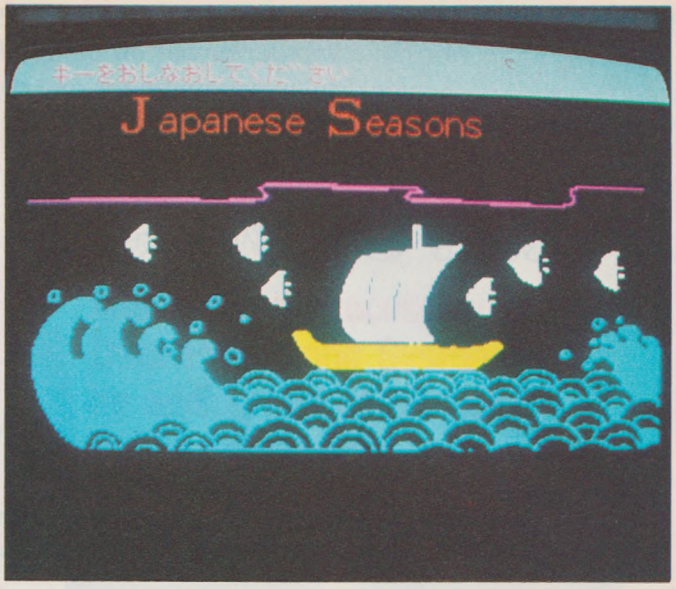
There are four kinds of input terminals:

- tablet
- keyboard
- those capable of directly reading hand drawn figures and photos
- those using a TV camera.

The displays give the viewer the impression that his or her wishes are respected with deference. Continuous delivery of a specified number of pages without requiring successive pushing of buttons will produce an entire sequence on a particular topic. These can be disclosed line-by-line from top to bottom, character-by-character from left to right, or by the familiar upward scrolling. The user can choose high or low scrolling speeds.

When the viewer orders merchandise, after reviewing the merchandise code number, size, color and quantity, he then signals whether these were correctly recorded, or if all were incorrect or some were incorrect. Cancellations are accepted within seven days of the order date.

Possibly the most agreeable quality of CAPTAIN is a kind of grace behind the composed pages, in the respectful imparting of desired facts and figures, the stories and games. The graphics have a stylized charm abet-



videotext format. (Photos courtesy of Nippon Telegraph & Telephone Public Corporation.)

ted by pastel hues and playful animation.

Conclusion

Now that AT&T and Western Electric seem to be coming aboard, even though they won't bring out a decoding terminal that meets their new standard until May 1982 at the earliest, consensus is that teletext and viewdata may yet get to be big business. Let's not hold our breath. But we can bet that small, imaginative electronic publishers—such as those making video games and software for micros—will have more and larger markets. As with the early years of autos and radio there may well be high birth and death rates for companies.

Some quotient of software programs on videotext, though, should be well worth our time. At their least they'll be convenient. At their best they may bring new kinds of enjoyment.■

↙See List of Advertisers on page 210

For the computer owner on the go, this portable terminal can provide color display capability for any computer with an RS-232-C port.

RCA's "Connection To the Computer World"

By Frank J. Derfler

Microcomputers may be versatile, but they can't be all things at once. If you enjoy using data communications systems, you may frequently find that your 32K dual-disk system is busy killing Klingons just when you want to check your electronic mailbox. You might want a quick stock market report, but it seems a shame to dump the program you are debugging just so you can get on-line.

What you need is a terminal to use just for data communications. While you are at it, how about one that is small, portable and rugged, costs less than half of what you would expect to pay for a standard video terminal, and can provide a color, graphics and sound display from any computer? How about one made by a leading U.S. manufacturer? Meet the RCA VP3303 color data terminal.

What It Is

This device is everything a complete terminal should be, minus the display. The display can be any available television set (color or black-and-white) or monitor. The terminal is small enough to fit into a briefcase with lots of room to spare. It is light and rugged enough to go anywhere and survive nearly any treatment. It provides an extensive keyboard and many special features such as reverse video, variable colors and variable pitch and tone sound. It provides either a current loop or RS-232C interface for a modem (not supplied). The entire unit retails for $389.

What's Inside

The heart of the RCA 3303 is an RCA 1802 CPU. It resides inside a tough low-profile case, along with 1K of RAM for the screen, 1K×4 of color RAM and an extensive character set in ROM. You can do a little local programming of the 3303, changing the way some characters are displayed and the print and background colors of the display screen, but essentially the RCA 3303 is a dedicated terminal device with a color display.

The keyboard surface of the VP3303 is unique. It is a tough membrane of flexible polycarbonate which eliminates the mechanical problems associated with other keyboard systems. It is easy to clean, moisture resistant and perfect for tough environments. If you have ever spilled even a few drops of coffee into a conventional keyboard, you know the trouble it can produce. The VP3303's housing is not waterproof, but a little carelessness won't cost you a new keyboard encoder.

The 58 keys can generate a full 128-character ASCII set. It certainly is nice to see the full keyboard capability with all of those brackets, lowercase characters, control codes and other symbols that can be so handy. Few microcomputers have such complete keyboards.

The television set (or a separate audio output if you are using a monitor) provides a tone each time a key is pressed, which gives the positive feedback missing in the touch.

Even after I used the VP3303, I had reservations about how the flat-faced keyboard would be accepted, so I took it to a local manufacturing company whose accounting staff spends a large portion of every day keying in payroll, accounting and personnel data. We replaced one of their on-line terminals with the VP3303 and a portable color TV set. The VP3303 is limited in display size by the bandwidth of the TV set, so it could only display 24 lines of 40 characters, but that was sufficient for many input functions.

The office workers got the feel of the keyboard after about 60 seconds on-line. They found their speed was slowed at first, but it improved to near normal after a few minutes. They praised the fact that they could move the keyboard around and even put it on their lap to type in a relaxed position.

The beep tone associated with each

Frank J. Derfler (PO Box 691, Herndon, VA 22070) is the author of the monthly Dial-up Directory column in Microcomputing.

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Microline 82A

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keystroke seemed to provide quite adequate feedback, although some of them found the change in tone when shifting to an uppercase letter to be a distraction rather than a help.

Interestingly, almost no one agreed on what color combination of letters and background was the most pleasing, but they all had definite favorites. Several liked black letters on a white screen. Not one person liked the white on green that researchers in the field recommend so highly.

This test application was more rigorous than the use RCA designed the VP3303 for. RCA advertises the VP3303 as "your connection to the computer world." They are obviously targeting it for home and light office use with information utilities, but the test proves that the keyboard is easily accepted by people who use data terminals in their daily work.

Sound and Lights

The color and musical abilities of the VP3303 can be put to use in several different ways. First, when you use it as a standard data communications terminal, you can arrange your screen the way you want to see it (e.g., blue on yellow). If you want to redefine any or all characters (perhaps to make all lowercase appear as uppercase, etc.), you can do that too.

Second, you can write programs in the host system which can address and move the cursor of the VP3303 all around the screen to draw figures and make the screen change colors and the terminal play music. The host system can be any computer with an RS-232C port. That means the VP3303 can act as a color graphics output device for a system like the TRS-80 Models I, II or III.

The graphics of the VP3303 can be very good. In the high-resolution mode you get 40 characters on 24 lines (low resolution is 20 × 12). Each character location is formed by a 6 × 8 matrix array of pixel dots.

Each ASCII character can be redefined to be any shape or combination of dots within the matrix. As an example, an apostrophe ('), or any other character, can be redefined to be an open square or any other useful shape. The host computer can then draw on the VP3303's screen by redefining characters as needed and sending strings of the right characters in the right places.

Text and graphics are easily mixed on the screen and pictures are painted with colored bits and pieces as the cursor moves around. This method of sending graphics via a slow-speed ASCII channel requires some tedious and repetitive programming, but it works well. A text editing program which holds often-repeated statements would be useful in writing the software needed to get the most out of the VP3303 system.

The RCA VP3300 terminals are rugged devices which provide a unique range of capabilities including color graphics display and sound. They can be connected to nearly any computer as a color display device.

Use with the TRS-80

If you use a smart printer like the Epson MX-80 with your computer, you already understand how the VP3303 can be used as a color output device. First, the smart peripheral has to be jolted into paying attention by the receipt of two ESCAPE codes. The command ESC ESC B followed by a number changes the background color on the screen of the TV or monitor attached to the VP3303. That sequence is easy to send from BASIC by entering:

```
LPRINT CHR$(27);: REM 27 is the ASCII code for ESC
LPRINT CHR$(27);: REM another one
LPRINT "B 5";: REM 5 is the number for yellow
```

All of these commands could be nested together on one line. Don't be confused by the fact that the LPRINT command normally sends the characters out the parallel port instead of the serial. On a system like the TRS-80 Model III, you can simply do a ROUTE command to route the printer output to the serial port.

A Model I program would have to call an appropriate driver routine for the serial port. The VP3303 is wired as data terminal equipment (DTE), which means it wants to receive data on pin 3 of the DB-25 connector. You may have to arrange the connecting cable to transpose pins 2 and 3 if your computer is also wired DTE.

This little program would be ex-

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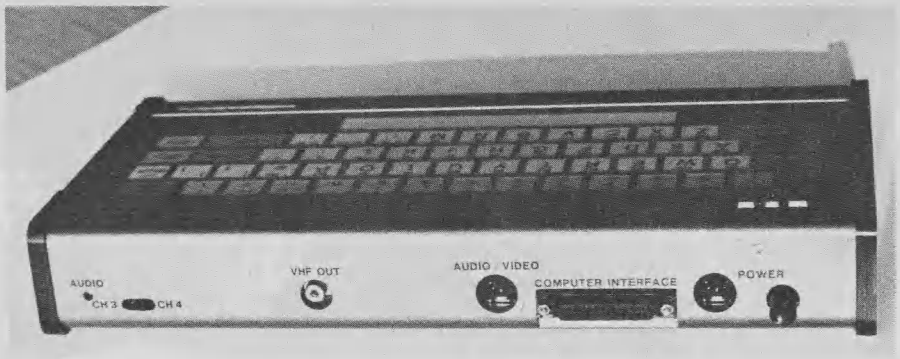

The rear panel of the VP3303 contains all the connectors and a few switches.

tended to send a graph or picture to the VP3303's screen. Similar LPRINT commands could be used to redefine how the terminal displays ASCII characters, moves the cursor, sends strings of characters and activates the music function.

On the TRS-80, the program would be written from the standard keyboard and the terminal would be used only as a display device. If the program is being written on an information utility or large computer system, the VP3303 can be used to write the program and display it. Various commands which will return the desired ASCII characters from remote systems are available.

Color on the Utilities

CompuServe and The Source are both close to offering color graphics service to their customers. CompuServe has a demonstration program on display at computer shows. It draws a weather map and other useful diagrams on the screen of a color terminal.

People at The Source have been talking about the same kind of service, but there is no firm word about the format to be used. The CompuServe color graphics format will not work with the VP3303. (You can write your own programs on CompuServe and they will play very well, but the utility's prepackaged pictures will not be displayed.)

The Source apparently will not use the CompuServe format, but it isn't clear what they will use. The industry still needs to sort itself out in the area of format, but for now the RCA VP3303 provides a fine way to display color graphics on big and small computers that think they are only spouting strings of ASCII characters.

Nitpicks

You can't have a fair review without a nitpick or two. The RCA VP3303 is a flexible, good-looking and rugged terminal device available at a reasonable price. But if you are going to use it actively (changing colors, etc.), you have to frequently manipulate a DIP rocker switch available through the left side of the case.

I often wanted to go off-line and into the half-duplex mode to "talk to myself" locally on the TV set, and set colors and experiment with graphics before trying to write a program. But this required manipulation of the rocker switch with some tiny, pointed instrument.

The "local-line" switch is right next to the switch which selects between RS-232C and current loop operation. You could easily knock yourself into the wrong transmission mode when selecting on- or off-line. I would suggest a separate on/off line switch as a minimum, and a separate half/full-duplex switch would be nice to have.

The DIP switch setting arrangement won't bother an installed user who simply wants to turn the system on and go, but if you are learning the system or doing any special local programming to use its capabilities, the DIP switches can be a nuisance.

The VP3303 has a built-in video modulator to provide a channel 3 or 4 rf signal to a TV set. The Model 3301, which sells for a little less, does not have the rf modulator. This family of terminals can provide a fine low-cost data communications capability, but they can also provide unique graphics, color and sound from any computer able to interface with a terminal.■

There is a line of DIP switches on the left side of the VP3303 which sets most of the operational parameters. Everything is easy to use, but having the local-line switch in this location can become a nuisance if it is needed frequently.

Ever tried to read computer sales literature? Ever tried to talk to a computer salesman? Ever tried to make a decision about which computer to buy?

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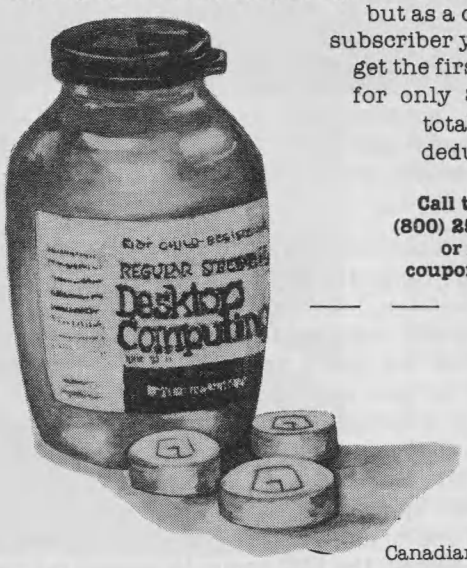

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ENGINEERING AND PRODUCTION CONTROL SYSTEMS

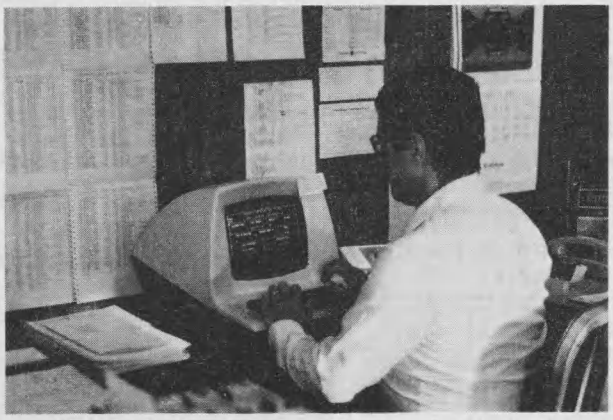
Company founder and president, Walter L. Myers (right), pictured with production engineer Joe Zellers who developed the production control software for the MSI computer system.

system. Since 1975, the MSI system has been expanded to accommodate four users simultaneously, performing a variety of plant monitoring functions and management programs."

"The system is equipped with 10 megabytes of hard disk storage presently and we plan to add an additional 10 megabytes of storage soon. The maximum downtime has been only one or two days in the 5 years that the system has been in operation. MSI has provided excellent technical support and willingness to help us with our special requirements. We have nothing but praise for MSI, they have provided excellent system support."

SPRING ENGINEERING AND DESIGN

"All of the production at Myers Spring is performed to exact customer specifications rather than to the manufacture of standard spring products. This causes an ever increasing demand for quick and efficient design and engineering capabilities. Many parameters have to be taken into consideration in the design of any particular spring, including wire size, wire type, material modulus, spring diameter, number of turns per inch, free length, spring loading, rate, solid height, working stress, working temperature, number of operating cycles, hysteresis, resonant frequency, expansion, and whether the spring has to be ground or not. It used to take over an hour for an engineer to design a spring taking into account all of these parameters. However, with the engineering software which we have developed for the MSI system, spring design can be completed in less than one minute by simply keying in the desired parameters. The MSI computer system not only designs the spring for us but prepares a complete quotation for the customer after consideration of the material to be used, the amount of waste, which equipment the production will use, the speed of the machines, the necessary labor rate, as well as the desired percentage of profit."



One of four workstations where design engineering, checking of sales order status, and production control monitoring is performed.

THE COMPANY:

MYERS SPRING COMPANY, INC.
LOGANSPORT, INDIANA

Myers Spring Company, Inc. was founded 35 years ago by Walter L. Myers for the manufacture of small mechanical springs which are used widely in mechanical appliances, electrical equipment, and by the automotive, construction, and many other industries. The Myers Spring company has grown to several million dollars in annual sales and employs approximately 50 people in its production facility.

Production engineer Joe Zellers comments, "we began looking at computer systems approximately ten years ago in order to keep up with the increasing demand of order processing, custom mechanical spring design engineering, and production control. In 1975, we selected the MSI system because they were the first company in the microcomputer industry to offer the necessary peripherals which would convert a microcomputer system into a usable business

The production facility at Myers Spring Co. is equipped with many automated machines for mechanical spring production.

SALES QUOTATION SYSTEM

Following the computer spring design procedure, with automatic quotation feature, the actual production begins. Each quotation is reviewed and compared to actual job cost reports on the production run in order to make any necessary refinements in the quotation system software. This feature of our system has greatly improved our ability to prepare accurate quotations and to insure profitability of the company.

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Each production work order is tracked by the computer system at each stage of the production process. First, each order is checked against the customer quotation for accuracy. As each order is processed, exact shop labor time is recorded, for each production machine used, and each stage of the production process. Summary reports are produced showing the total amount of material used, time used on each production machine, amount of material used, and a total cost figure for each work order.

SALES SUMMARY REPORTS

The system is designed to produce monthly sales summaries which show the amount of products sold by each salesman, complete with dates, order numbers, type of product, quantity, type of material, material cost, sales commissions, etc. Totals for each desired category and for each salesman are reproduced.

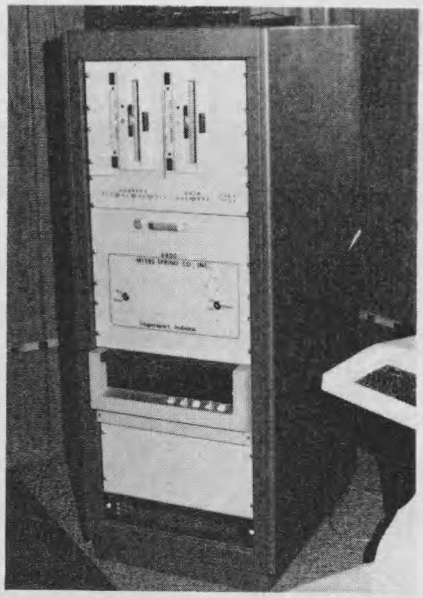
ACCOUNTS RECEIVABLE SYSTEM

Each morning, invoices are generated for orders which will be shipped that day. The accounts receivable system maintains accounts for over 500 active customers. The system produces monthly statements complete with aging of open invoices.

MULTI USER CAPABILITY

The MSI system is equipped with four user terminals presently which are available for use simultaneously by the following departments: Order department, for entering new orders and checking order status. Inventory department, used for checking to see whether a particular product has been produced previously. Invoicing/Cost Accounting, used for preparation of invoices and for entry of labor and material cost accounting information. Design Engineering, used by company engineers to design new products.

Order entry, invoicing, monthly statements, and other management reports are carried out at this workstation at Myers Spring Co.



The MSI system at Myers Spring Company is equipped with 10 megabytes of hard disk memory, dual floppy disk drives, a high speed printer, and four user CRT terminal workstations.

GENERAL LEDGER TIE-INS

The MSI system automatically prepares journals for cost accounting information and sales data which can then be posted to the general ledger. Complete income statements and balance sheets are produced by the general ledger programs on the system.

MULTIPLE MANAGEMENT REPORTS

The MSI system is used in many different areas of the company in order to provide more efficient and effective management of our production facilities. Several of the reports which we obtain from the system are: **production schedules, due list for orders, new orders list, production summary by department, salesman's reports, individual customer reports and order histories, time studies, sales quotations, design engineering, sales summaries, customer statements, general ledger balance sheet and income statements.**

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The day when we can affordably hook our micros up to the television camera is fast approaching. Until then, let's imagine the ideal "eye for your computer."

Lights . . . Camera . . . Action

By James M. Hansen

Of the many microcomputer peripherals available, the television camera is probably the most fascinating. The gift of sight to a computer can open the door to a host of uses not otherwise possible, including motion study, cartography, image analysis and robotics.

While I don't want to get too bogged down in detail, I want to discuss some of the problems of making a high-performance television interface. Hardware is now available, and affordable enough so that advanced hobbyists can actually start planning such an interface.

The ideal interface should accept any standard television signal, digitize it (convert the picture portion into a string of numbers) and place it into memory. Further, it should do this to a single frame; that is, one complete scan of the picture. This takes 1/30 of a second for U.S. television signals.

The successful interface should also be able to display the image on a monitor with the same resolution that was used to digitize the original image. System resolution must be at least as good as that seen on a standard home television set.

Our ideal interface would also provide at least 32 shades of gray scale. This corresponds to five bits of information for every dot that you digitize. The more shades of gray you can get, the more natural the shading of the pictures you digitize. Line drawings, maps, cartoons and the like generally look fine with only one bit of information (dot on or off) per displayed

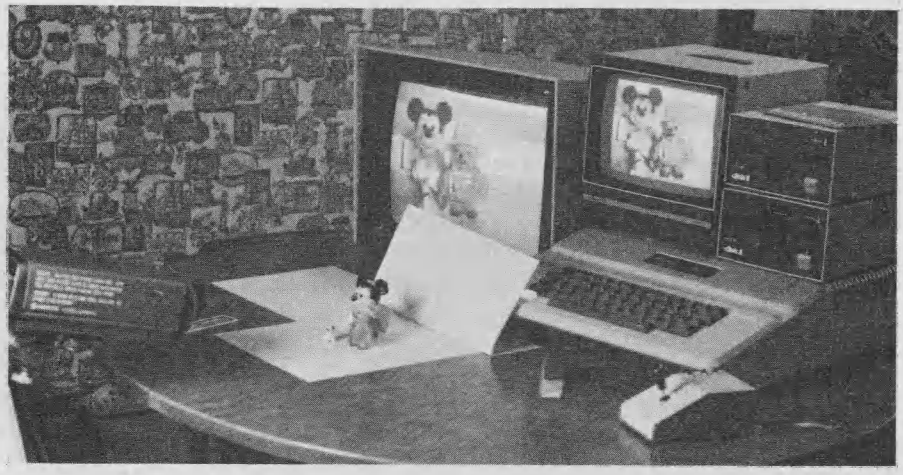


Photo 1. The photographic setup used to make the stereo pictures. The larger monitor displayed the picture directly from the camera, and the smaller monitor atop the Apple shows the digitized image. Careful lighting is necessary to get maximum detail.

Sample 1. This is a picture of one of my children. One of the problems of child photography is getting them to hold still long enough (three or four seconds) for the entire image to be digitized. The background in this case is distracting and probably should be something with little or no pattern.

Address correspondence to James M. Hansen, Box 234, New Boston, NH 03070.

dot, but actual photographs and most other video images require a gray scale to be recognizable.

This, then, is the ideal interface: with the press of a button, it will snap up a single frame of video from almost any source, put it into some kind of digital memory which can be read and stored on disk in normal computer fashion, and display the frame on a monitor with picture fidelity as good as that found on most network broadcasts. Can it be done today at a reasonable cost?

Yes, If . . .

The answer is yes, if you design and build it yourself.

Let's look at what we have to understand to build the ideal interface.

First, the video signal. Fig. 1 shows in some detail the standard used in the United States. The major portions that concern us are the vertical interval, which will indicate the beginning and end of a picture frame, the horizontal sync and blanking pulse and the video portion of the signal.

A complete video frame consists of 525 horizontal lines. The frame is made up of two fields. Each field consists of 12-1/2 lines that provide vertical synchronization information and 250 lines that contain picture information. The fields are overlapped so that one provides information for even horizontal lines in the picture, the other odd lines.

The odd field starts its scan in the center of the top line of the picture, and the even field begins at the top left of the picture, under the first line of the odd field. Each field is completely scanned in 1/60 of a second, and so a frame is completed in 1/30 of a second. The timing of the fields was chosen so that 60 cycle hum and interference would be less noticeable since it would be in sync with the picture and thus stationary (or nearly so).

Fig. 2 shows a block diagram of our ideal television interface. It consists of a video analog-to-digital converter and a high-speed memory to hold the digitized image, complete with an interface to your computer. A digital-to-analog converter and attendant logic to add vertical and horizontal sync signals for output to a monitor are also included in the interface.

The critical elements that determine the maximum picture fidelity are the analog-to-digital converter (ADC), memory speed and size, and the digital-to-analog converter (DAC). We will assume that sufficient hardware exists to strip out the sync portion of the video signal and synchronize the ADC properly to grab a frame starting at the beginning of the frame, rather than starting at some random place in the picture.

There are several types of analog-to-digital converters. For our purposes we will divide them into two classes: fast (of the flash variety), and slow (which use successive approximation or other standard techniques to digitize analog signals). It is now possible to buy single-chip monolithic ADC converters in the $10 range which do a respectable job. They are slow by video standards, but for this example, let's say that we located one that would do a single conversion to eight bits in ten microseconds (μs).

Since each horizontal line takes about 63 μs, at best this converter will give us 6.3 data points every horizontal line. It is therefore not acceptable for the ideal interface, but let's not drop it yet. We could divide up the horizontal line into, for example, 1200 data points and use this converter to digitize six points of every line each frame. If we move the six points we digitized a little every time, we could completely digitize a frame of video in 200 frames. At 30 frames per second, that works out to 6-2/3 seconds, practical for image reproduction of still objects at quite good resolution.

The real answer to our ADC requirement is the flash converter. This type of converter is fundamentally different from other converters. The normal, slow type of converter digitizes a signal by generating a test volt-

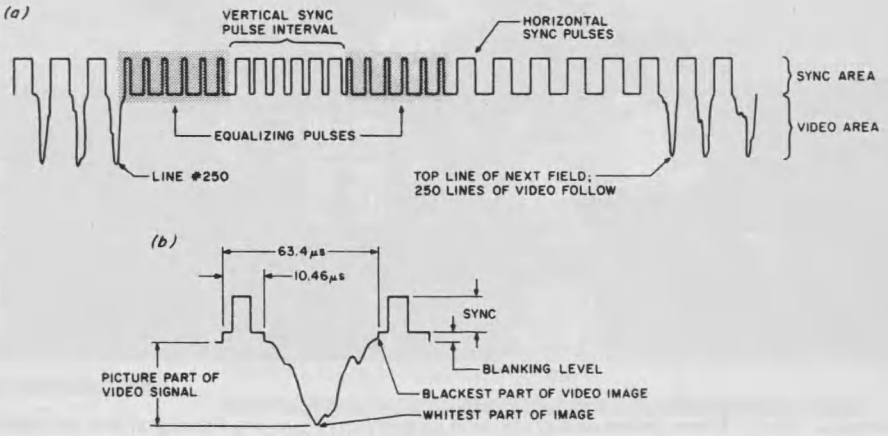


Fig. 1. Standard (U.S.) television video waveforms. Fig. 1a depicts a complete field showing the vertical sync area, horizontal sync pulses and picture areas. The equalizing pulses surrounding the vertical sync pulse interval maintain horizontal sync in the television monitor during the vertical interval and provide for odd-even fields mentioned in the text. Fig. 1b shows the waveform for an individual scan line. The time for one line is shown for a black and white picture. Color scan times are longer, 63.5 μs per line. (This frequency was chosen as 2/455 times the color burst frequency.) The blanking and sync pulses are "blacker than black" since they extend past the blackest area of the video portion of the signal. The blanking pulse is used to turn off the video display while the beam is moved to the left of the picture for the next scan line. Many inexpensive vidicon cameras combine the sync and blanking pulses into a single rectangular pulse.

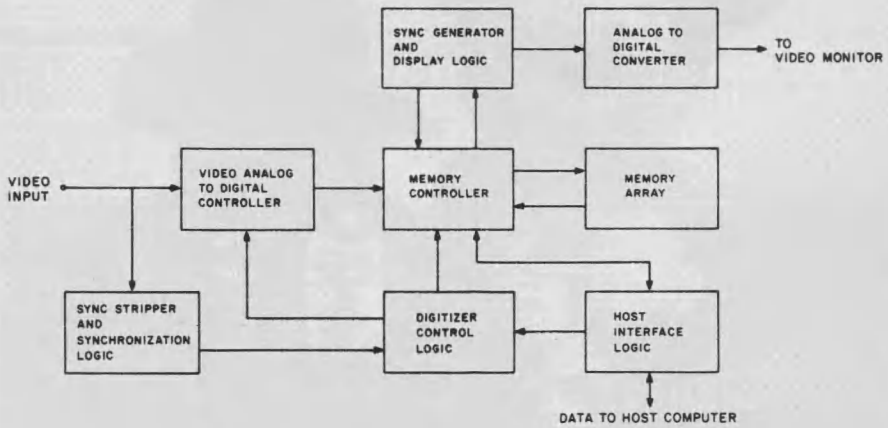


Fig. 2. A block diagram of the ideal television interface.

age and comparing it to the input voltage. The test voltage is adjusted until it matches the input voltage within the tolerance of the converter. Since the converter uses digital techniques to generate the test voltage, the digital value can be read out when the input and test voltages are matched.

The flash converter obtains greater speed by using many comparators (and an equal number of test or reference voltages) simultaneously to determine the input voltage. The outputs of the comparators are sent to an encoder that generates the digital value of the input voltage. If we had an eight-bit flash converter, it would have 256 comparators and voltage references built into it. Getting all the comparators and voltage references to be accurate in relation to each other, plus mixing analog and digital logic on one chip is no mean feat, but it is now done by both TRW and Analog Devices.

TRW's converters have been on the market for some time, and command a fairly high price. Analog Devices has just introduced two monolithic flash converters, the AD5010KD and AD6020KD. They are packaged in a 16-pin DIP and are priced at $189 and $84, respectively, in hundreds. All that is required is two power supplies, an input signal and a TTL encode command.

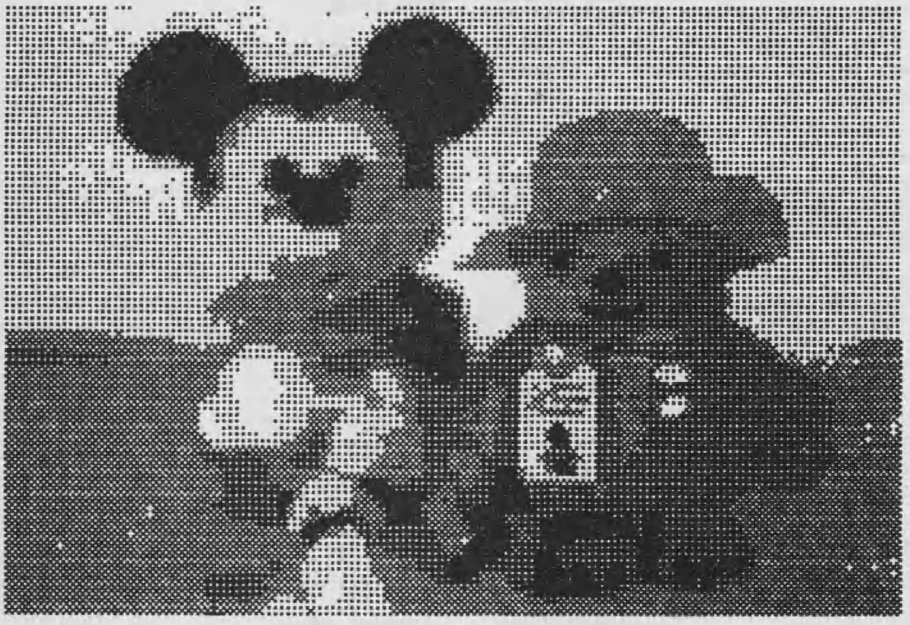
The AD6020 digitizes data at rates up to 50 million conversions per second, and the AD5010 up to 100 million. That translates to 20 nanoseconds (ns) for the slow one, and 10 for the fast one. Since the data can be encoded faster than the gate propagation times (the time it takes an input signal to reach the output of a gate) of standard TTL logic, these converters will require use of Schottky or ECL logic to be run at full speed.

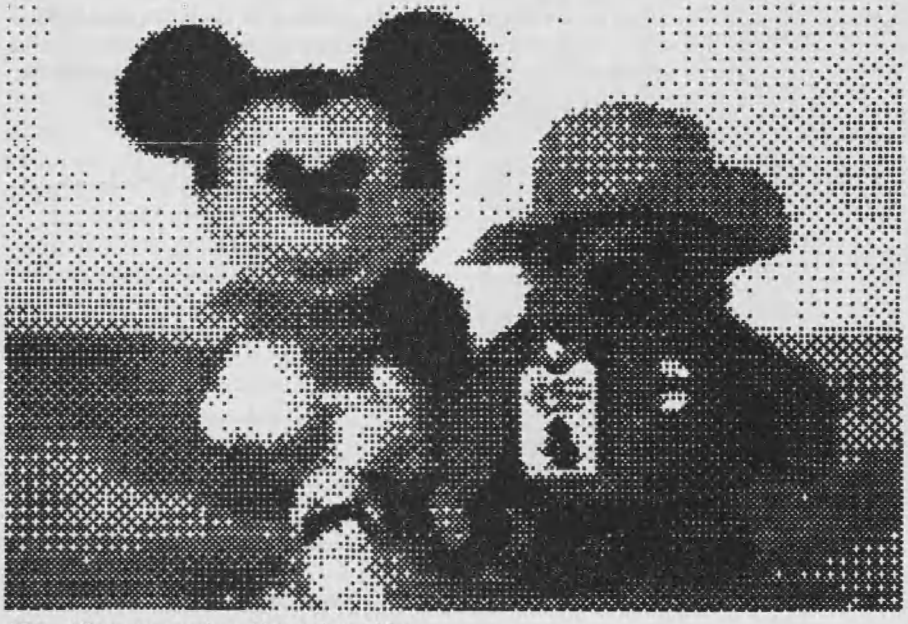
Look at the resolution we can get using these relatively low-cost devices. A conversion rate of 20 ns/conversion gives 50 samples per μs, or about 3200 readings on a single horizontal video line. This is clearly sufficient for our ideal video interface. Since these converters digitize to six bits, we will get 64 shades of gray, again satisfactory for our interface.

Before you rush out and buy your converter, I want to quote a sentence from the Analog Devices announcement: "... it is important to note that the design principles for high-speed conversion have not been revoked by the availability of a chip that does most of the work." They also mention that a complete board for prototyping is available. It would appear that it is now possible to build the front end of our high-performance video interface with confidence it will work.

Next we must design a memory that will accept data at the rate our converter produces it. First we should look at how much memory we need. This is entirely dependent on the desired resolution. Say that we would like 1024 dots (picture elements, or pixels) per horizontal scan line. Since there are 500 lines in the frame, we are talking about a half megabyte of memory, a practical amount by today's standards. Our problem here is that there aren't too many cheap 20-60 ns memories around.

The memory array we need would consist of 32 banks of 16K byte memory chips, or eight banks of 64K parts. Since 64K memory chips are quite expensive and/or not readily available,





Sample 2. Mickey Mouse (patron saint of computer hackers everywhere) and Paddington Bear were two figurines chosen for several experiments. Sample 2a (top) shows the image with a dither matrix of two (four shades of gray); 2b (bottom) used a matrix of four (16 shades). Notice that the images seem a little fuzzier (loss of detail) in 2b, but are better defined because they are separated from the background. I found that the image displayed on the Apple monitor often looked better than what was printed. It takes a bit of effort to adjust the monitor contrast and brightness to "match" the printer output.

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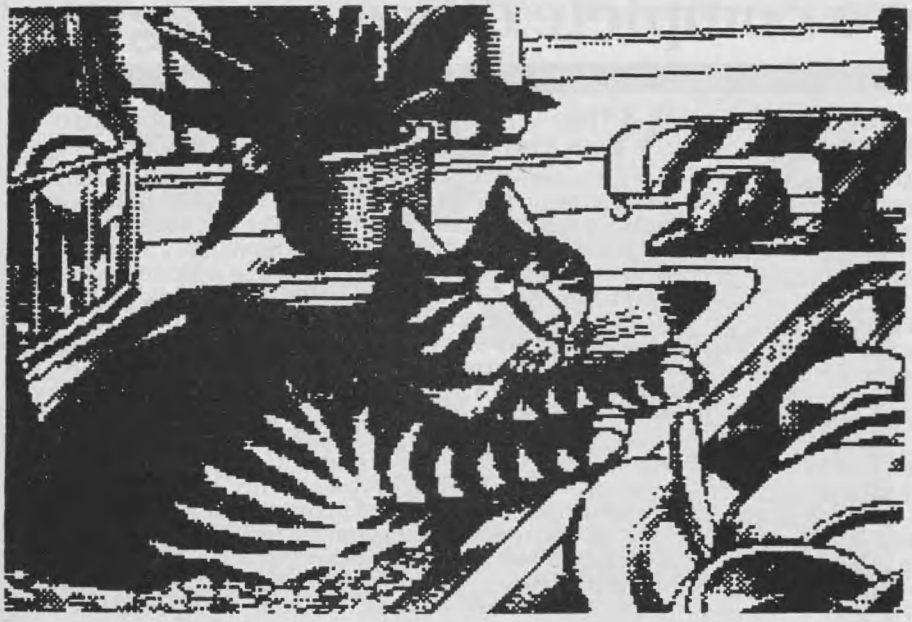
we will think along the lines of using 192 16K chips. They can be had for under $5 each, and so the bulk of our memory unit will cost under $1000, if you build it yourself.

Since the standard 16K memory access time is around 150 ns, some paging scheme will have to be employed to allow proper setup and access times. We will need to access the memory 1024 times each 63.4 μs, which works out to once every 61.9 ns. We can either set up the memory as several pages and write each datum to another page, or splurge and use 120 ns memories and design a two-page system. The two-page system will be easier to design and get running.

The final video section is the playback or memory display section. Here again, high data rates will require a good deal of thought and a fast digital-to-analog converter to realize high-quality output. There are many suitable fast DACs available. Horizontal and vertical synchronizing signals must also be generated and mixed with DAC output.

Since one of the main objectives of the interface is to allow a computer to process the video image, a third interface to the memory must be provided for computer access. I can see no requirement for either display or data capture during computer access, so this will take some burden off the memory design. It might be interesting to note the time it would take to unload this memory. If the computer access port were set up as a parallel port, and each byte required, say, 50 μs to be read by the host, and no disk access time delays were encountered by the host, it would take about 25–30 seconds to read it out. If floppies were used to store the data, you would probably want to devise a special disk format to hold the video data since standard formats have more overhead, thus less capacity.



Sample 3. This is an example of digitized line drawing. Line drawings generally look good as long as the lines are not too thin to be resolved by the Apple screen. Notice the staircasing (also called "aliasing") of the horizontal lines. This is caused by the resolution of the display being so low that the effect is visible. Staircasing will always be present in any digital display; the trick is to use enough lines to make it invisible.

Sample 4. A map of the New London area of New Hampshire. It was made with four shades of gray, which cost detail, but allowed the shading to appear. Some of the larger highway route signs are legible when no gray scale is used, but other details including some roads are lost. Best detail recovery is obtained with strictly uniform lighting and black and white objects.

But Seriously, Folks

All the foregoing is really a dream. If there are any of you out there that have the financial, technical and grit capacity to build even a subset of the ideal video interface, I would like to talk to you. I would guess it would take over $2000 to complete and probably six months to a year of intensive effort to get the hardware up and running.

However, there are at least two practical, off-the-shelf television interfaces that are available today. Neither has performance approaching the ideal, but as the fellow who owns a Piper Cub tells the one who dreams of an F-16, "they sure beat hangar flying."

The first has been around for quite some time and is sold by Micro Works (PO Box 1110, Del Mar, CA 92014, 714-942-2400). It is slow, but quite inexpensive and works through a parallel port. My understanding of its operation is that you send it an address and it returns a digital value of the addressed portion of the image. This makes the data it returns similar to that of the ideal interface.

Computer Station (11610 Page Service Drive, St. Louis, MO 63141, 314-432-7019) has recently introduced their Dithertizer II, which I have used for some time. It plugs directly into an Apple interface port and takes less than five minutes to install. It comes with a short manual, a disk with machine-language driver

routines and a BASIC demo program. Your Apple must have a disk. The Dithertizer II requires a TV camera that accepts external sync.

The price of the Dithertizer II and a Sanyo vidicon camera is $650. This includes a long camera cable, so all you need to start operation is a tripod on which to mount the camera.

The manual is complete and gives good, clear installation instructions, reasonable operating and user information on integrating their various screen-dump programs (see "A Tale of Two Screen Dumps" in the April 1981 issue of *Microcomputing*, p. 174) and a source listing of the BASIC demo program. (If you want screen dump capability, you will have to purchase this program separately.)

Operation of the Dithertizer II is not the same as the ideal interface or Micro Works digitizer. Instead of storing numbers corresponding to the value of the video signal, a translation is made based on the dithering matrix size, and an appropriate number of display dots in the Apple high-resolution graphics display memory is turned on and off to render a gray scale.

All output of the Dithertizer II is sent directly to the video display memory. A dithering matrix of 1×1 (no gray scale, only black or white is displayed) to 8×8 (64 apparent shades of gray) may be selected. An unfortunate consequence of using larger dithering matrices is that, because of Apple's limited resolution (280×192), image detail is lost. Another consequence of storing information in this format is that, while it is perfectly natural for display purposes, it is difficult to process the data in any way other than to store or dump it on a printer.

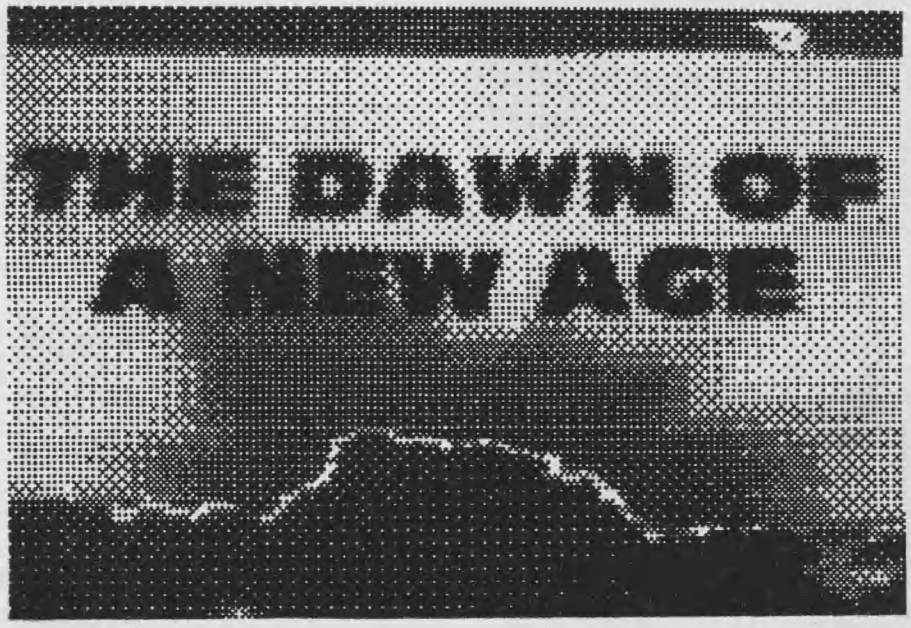
The demo program, written in BASIC, is designed to let you use the system as soon as you have everything plugged in and running. Both the keyboard and game control paddles are used. Single keystroke commands are issued to the controller to dither (capture a picture), change the dither matrix, stop dithering and freeze the image, save the image to disk, print the image if you have installed their screen dump program for your printer and contour an image (draw an outline of its light and dark borders). The game control paddles are used to adjust the software equivalent of brightness and contrast.

Variables for controlling the dithering and contouring processes as well as machine-language entry points for these routines are clearly spelled out and can easily be driven by your own BASIC or assembly-language programs. Any questions that may arise are easily answered by reading the source listing of the demo driver program.

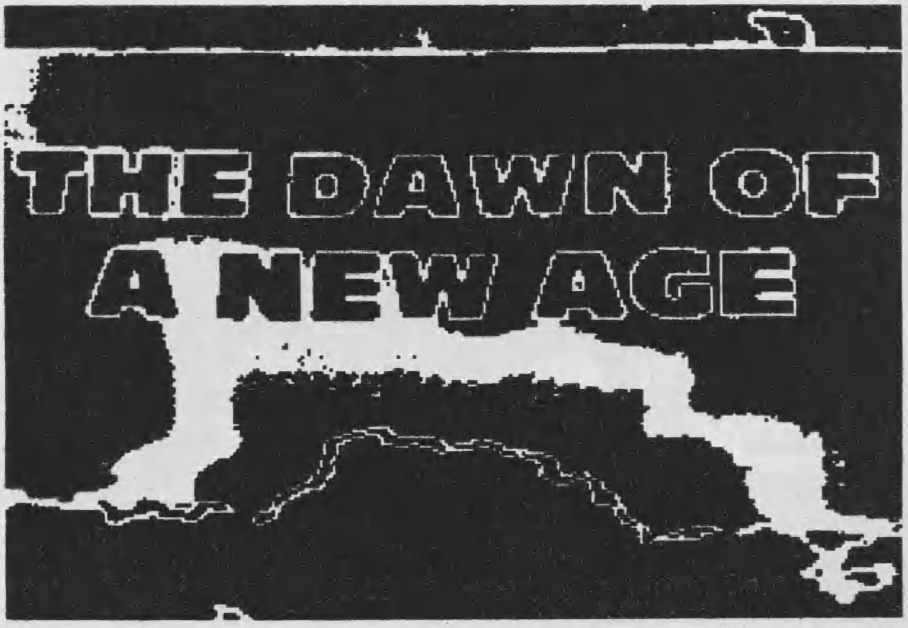
I installed the printer driver software for the Paper Tiger 460, and all the print samples shown were printed with the 460. Each of the pictures shows one aspect of the operation of the Dithertizer II. Photo 1 shows the setup I used. I found that uniform lighting was absolutely essential to get the best pictures. Also, a video monitor to observe the video input is necessary. Without it you cannot tell if the camera is focused or if the image is smudgy because of poor lighting. Getting the hang of adjusting the camera, lights and the game paddles takes a little time.

I tried to use one of the Programma joysticks, but found that the game paddles worked far better for me. It is hard to change just one axis on the joystick, and the backlash in stick movement causes confusion when a small adjustment is required.

The Sanyo camera supplied by Computer Station works well, but the lens does not have an iris. It is not



Sample 5. This was copied from a color advertisement, and dramatically shows the ability of the Dithertizer II to locate the edges of a video image. Sample 5a (top) is the normal picture, and 5b (bottom) the "contoured" version. Careful adjustment of the game paddles is necessary to obtain this clarity.



possible to adjust the depth of field or to compensate for peculiar lighting conditions. It does have a very effective electronic light compensation circuit which can be annoying at times since one small bright spot in the picture area can cause the rest of the picture to be washed out.

The normal beam and target controls are screwdriver adjustable, but the (Sanyo-supplied) manual merely says not to adjust them and lets it go at that. (Could it be that the Japanese are finally learning to write American-style manuals?)

One very good feature of the camera is that the vidicon can be moved in and out in relation to the lens, thereby allowing it to focus inches away for extreme closeups.

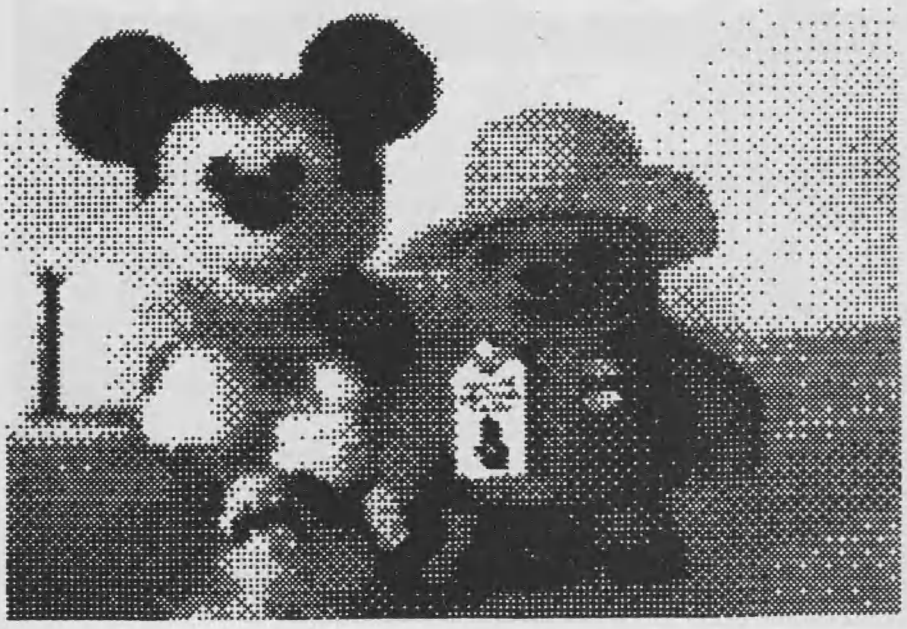
Many Applications

As can be seen from the various print samples, the Dithertizer II can be used for many applications. It can grab a single frame only when using the 1×1 matrix, and takes several seconds when an 8×8 (64 gray scale) image is to be digitized. Its resolution is limited to that of the Apple high-resolution graphics display. It is, however, a practical, high-quality television interface that works without a hitch right out of the box.

The comments in the captions on the print samples explain in detail what was being done to show the various capabilities of the Dithertizer II. My personal impressions of this unit are that it can digitize live television images from a camera and display them to the capability of the Apple's high-resolution graphics display. The catchword here is display. I do not think that it will be possible to do a lot of image processing—that is, computer enhancement and the like—without a considerable amount of work in 6502 assembly language.

But for applications where a television camera, image display and printout are useful, this is a very workable system. I had originally hoped that the resolution would be sufficient to be useful in storing maps. I found that coloring and shading on typical road maps caused trouble since they appear as different gray levels and smudge. Also, the Apple display just does not have enough resolution.

The search for the ideal video interface goes on. I suspect that in the next couple of years we will see the cost of suitable equipment come down with a corresponding decrease in circuit complexity. When this happens a whole new area of exciting microprocessor development will open up.■



Sample 6. A stereoscopic pair of pictures. Properly aligned and viewed through a stereoscope, a small dog figurine will appear in front of Paddington Bear, then Mickey to the left and farther back, and finally the L. The pictures were taken in the typical manner, except the camera was moved to the right for the bottom picture.

References

Reference Data for Radio Engineers, Fifth Edition. Howard W. Sams & Co., Inc. Complete description of U.S. television standard.

Data Acquisition Handbook. National Semiconductor, 2900 Semiconductor Drive, Santa Clara, CA 95051. A catalog of National's data acquisition products including analog to digital converter chips. Some useful application notes.

Analog to Digital Conversion Notes. Analog Devices, Inc., Box 796, Norwood, MA 02062. A must for anyone working with A-D conversion and analog data processing. A most readable and well-written book. Well worth the $7.95 price.

Analog Dialog—Vol. 15, No. 1. Analog Devices. A description of the AD5010KD and AD6020KD flash converters.

General Catalog. Burr-Brown, PO Box 11400, International Airport Industrial Park, Tucson, AZ 85734. A complete listing of their data acquisition products including some application notes.

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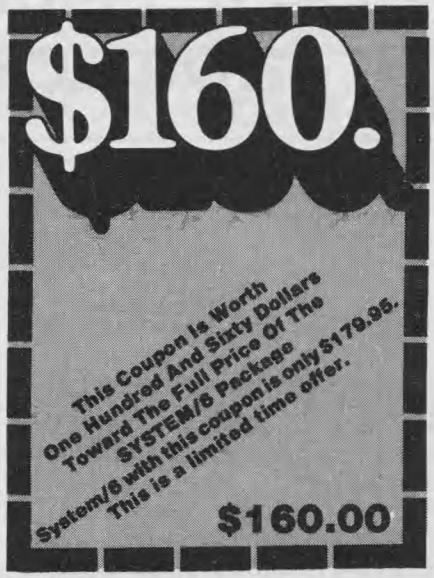

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Perhaps the class of the Japanese computers targeted for the U.S. marketplace is NEC's PC-8000.

Japanese Invasion: Part 3

By G. Michael Vose
Microcomputing Technical Editor

While Casio and Sharp have managed to produce competitive new microcomputers for the American marketplace, the most talked-about new Japanese computer is the Nippon Electric Company's (NEC) PC-8000. This Z-80 based machine has been favorably compared to California's Apple computer. Because of the similarity, industry experts seem to feel that NEC has the best chance of securing a significant slice of the U.S. personal computer market.

The PC-8000 (when will the Japanese name a computer the "Cherry Blossom" or the "Mt. Fuji"?) supports color, is as fast as the Apple or the TRS-80 and has a competitive price tag. NEC has done its homework, too, in preparing the kind of solid, professional support that fancy hardware needs—software, documentation and training materials.

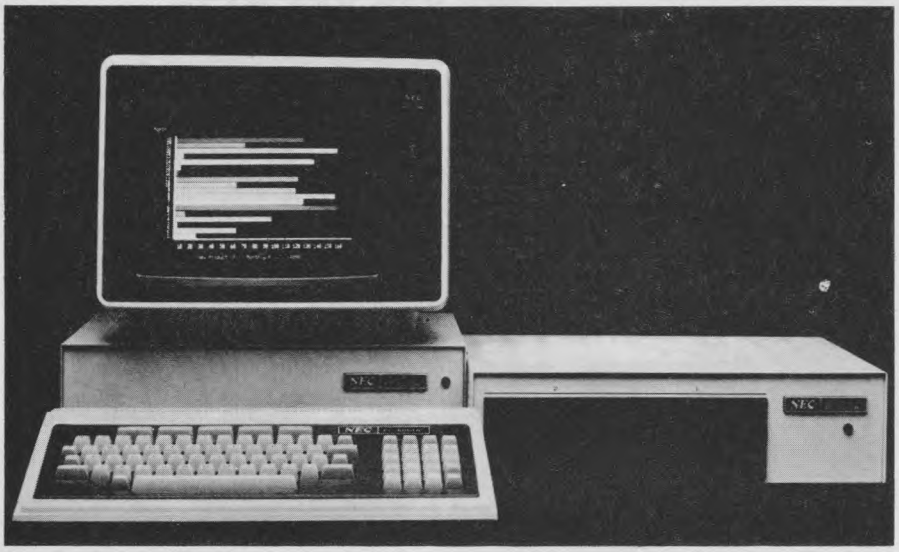
The PC-8000

NEC's new microcomputer is an amalgam of several separate components. The PC-8001A keyboard unit contains the microprocessor and 32K bytes of user memory. The PC-8011A expansion unit that came with the unit tested here at the *Microcomputing* editorial offices contained an additional 32K bytes of user memory plus a 24K byte N-BASIC ROM interpreter and an 8K byte custom PROM, the PC-8031A dual disk drive unit and the PC-8041A monochrome monitor. System options include the PC-8032A disk unit, which permits expansion of the system to four-drive capacity; a PC-8023A dot matrix printer; the PC-8043A color monitor; the PC-8012A expansion unit (this expansion unit has more I/O ports than the PC-8011A); and a cassette tape recorder.

All components are housed in metal or plastic cases; the color of the components is a standard off-white or cream color. The monochrome monitor has a green phosphor screen which will support 80 or 40 characters by 20 or 25 lines. The N-BASIC command, WIDTH x,n (where x = characters and n = lines), allows you to control the display size.

The keyboard features 77 keys plus five special-function keys. These keys are separated into a standard typewriter-like keyboard and a numeric keypad. There is a standard English character set, and an alternate Greek character set which can be called by simply pressing the ALT CHAR key. There is also a graphics character set, which is called by pressing the GRPH key. This graphics set includes lines, circles, dots, triangles, playing card symbols and a variety of other graphics images.

The PC-8000 features inverse video



The NEC PC-8000 system includes a monitor and dual double-density disk drive unit.

G. Michael Vose is a technical editor for Microcomputing *magazine. His review of the Casio FX-9000P appears on page 101 of the September issue, while his review of the Sharp YX-3200 is on page 90 of the October issue.*

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capability, including inverse field blinking. The on-board editor is a screen editor, not a line editor. The computer has terminal software in ROM so that it can be used as a terminal for another computer. This terminal capability is accessed from N-BASIC using the command TERM(w,p,c,a), where w = word length, p = parity, c = clock drive ratio and a = auto line feed. Once in the terminal mode, the PC-8000 can communicate with other equipment through the RS-232C interface.

The PC-8000 disk-based system will operate under NEC's proprietary operating system, called NECDOS, or the CP/M operating system. The disk drives are double-density controlled and will allow the storage of 177K bytes of data per formatted 5¼-inch disk.

This computer complies with FCC regulations regarding radio frequency interference (rfi). The unit tested did interfere with a television near it and plugged into the same wall socket. This situation was remedied by moving the computer a short distance away from the television.

N-BASIC

The BASIC chosen for the PC-8000 is a Microsoft, Inc., BASIC called N-BASIC. It's similar to other versions of Microsoft BASIC running on the Apple, Radio Shack and Commodore micros. It is a powerful BASIC, containing a variety of commands unique to the PC-8000. It permits the access of the machine-language level of the computer from BASIC, using PEEK and POKE, USR and VARPTR.

The Z-80A compatible processor running on a 4 MHz clock makes the execution of the PC-8000 N-BASIC commands as fast as on the Apple and TRS-80. This is a contrast to the Casio and Sharp computers, which were much slower. N-BASIC uses floating point arithmetic (integer division is also available, a feature that will save a few bytes of code), single-precision numbers to seven places and double-precision numbers to 17 digits.

At the Top

From a hardware point of view, the PC-8000 is a solid, professional product. The system's best feature, however, may be its documentation and training materials. NEC has spared no expense to provide as much written information about the system as possible—with one exception.

As a former documentation technical writer, I'm impressed more than most by good documentation. The PC-8000 documentation impressed me a great deal. It includes reference manuals for each individual piece of hardware except the monitor. There are separate reference cards summarizing the N-BASIC commands, plus a card cross-referencing N-BASIC commands with their equivalents in Apple, Radio Shack and Commodore versions of BASIC. The N-BASIC reference manual is complete, well-indexed, neatly organized and attractively printed. In addition to these manuals, there is a user's manual that presents a system overview.

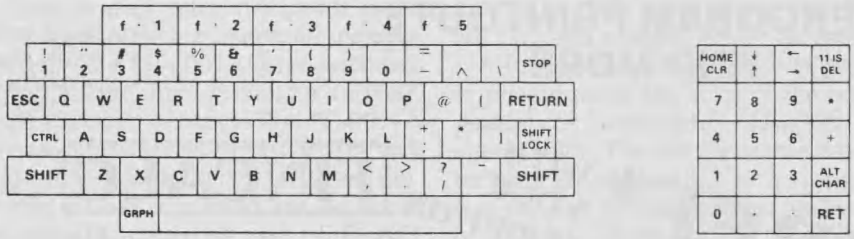
There is one glaring omission, however. Except for instructions on how to format and to back up a disk, there is virtually no information on the NECDOS. There are seemingly no utilities for the system—or at least no mention is made of any.

NEC apparently felt that all these materials were not enough, however. In addition to these manuals, there is a PC-8000 training program, a package that combines text with audio cassettes to teach the novice how to set the system up, turn it on and begin writing simple N-BASIC programs. There is an introduction to computer math and instructions on disk and printer use. There are separate training programs for the two principal pieces of software that NEC has purchased to support the PC-8000.

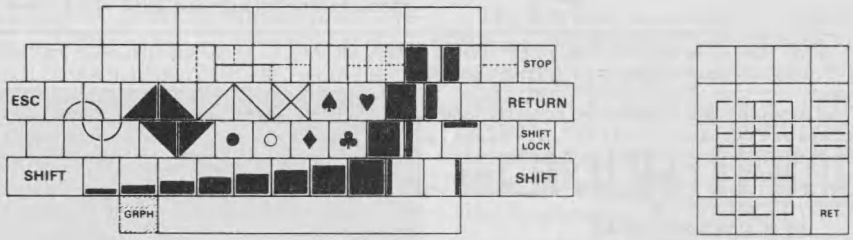
Software Support

NEC has recognized the fundamental need for software support. The company has selected two software packages and tailored them for the PC-8000. These packages include the Benchmark Word Processing system and the Target Planner. The Benchmark package is a product of Metasoft Corporation and the Target Planner originates with Advanced Management Strategies, Inc. The Target Planner is a VisiCalc-type "what-if" business projection package. Both packages are high-quality software offerings, and NEC has enhanced them by customizing the manuals for the PC-8000. AMSI will produce the training program for the Target Planner.

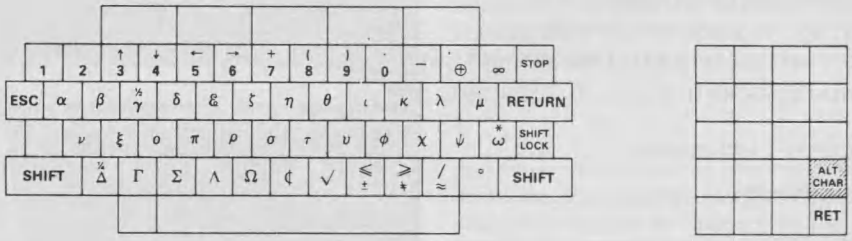
Since the PC-8000 operates under the CP/M operating system, the entire existing CP/M library of software will be immediately available to the PC-8000 user. This software will make the PC-8000 a serious contender in the small-computer marketplace. ■



Standard keyboard.



Graphics characters.



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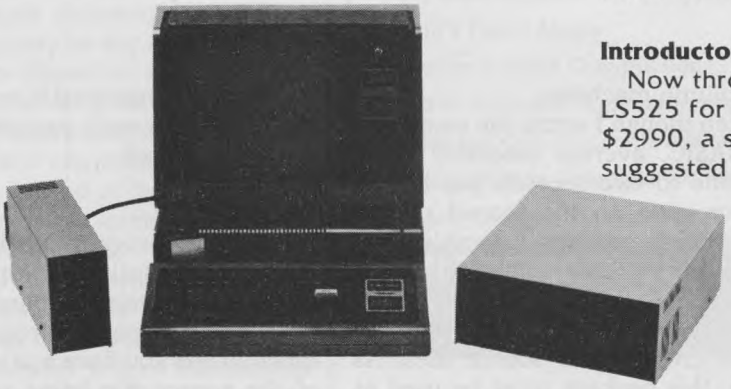

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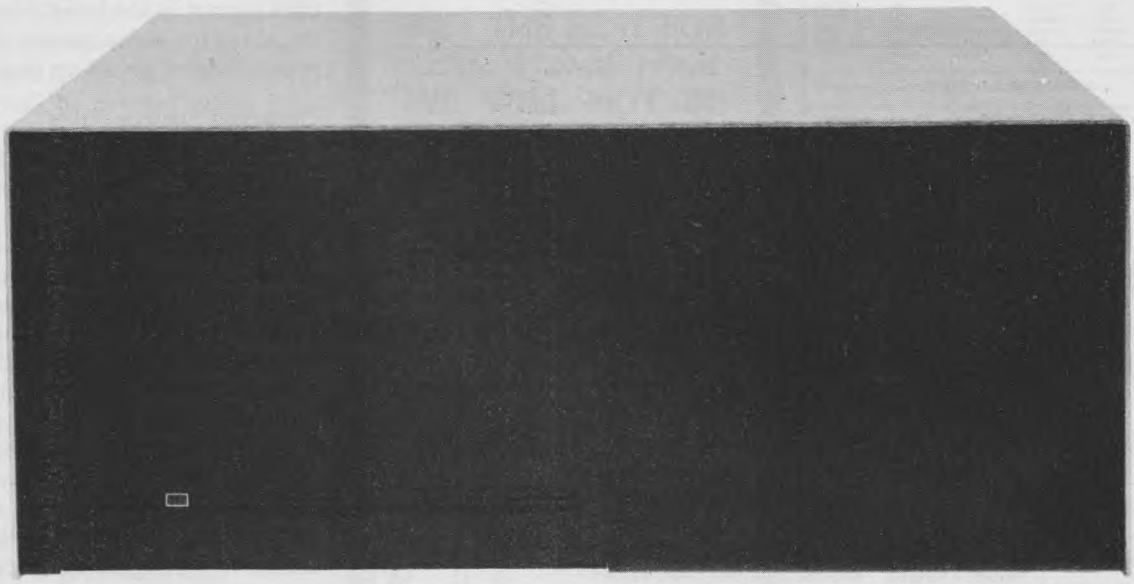

laredo systems inc.

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Here's a powerful, yet easy-to-use, BASIC assembler that can assemble any size program.

A BASIC Assembler For the PET

By Robert Baker

This simple yet powerful two-pass assembler for the Commodore PET directly generates loadable program disk files. It is written entirely in BASIC so it should run on all models. All disk commands are sent via the disk-command channel so the assembler will work with either DOS 1.0 (2040 disks) or DOS 2.x (4040 or 8050 disks). The programs require a Commodore Floppy Disk and at least 8K bytes of memory. A printer should be used to take full advantage of the features provided.

However, it is designed to be run on the 40-column screens and has not been upgraded for the newer 80-column machines.

Even though I wrote the assembler in BASIC, average assembly times are one to two seconds per line of source code on the second pass. I tried to improve the assembler performance by limiting available functions and by doing certain prechecking of fields with the Editor program when creating the source files. As such, this package must be used as designed for best results.

The major advantage of this assembler is that it can assemble any size program, since the source files are stored on disk. Also, since the output is actually a loadable program file, the address range used is not restricted, as long as each program is one contiguous block.

n	a decimal number example: 12369
$n	a hexadecimal number with a dollar sign ($) prefix example: $A0F2
symbol	symbolic value, value of symbol specified example: TAG12
*	the current program counter value
char	ASCII literal, equals ASCII value of first character after the apostrophe (') example: 'S

Table 1. Instruction and assembler directive operands.

value *or* +value	positive value of operand
-value	Two's complement 16-bit value
value1+value2	adds value2 to value1 enters 16-bit result
value1-value2	subtracts value2 from value1 enters 16-bit result
value1/value2	divides value1 by value2 enters 16-bit result

Table 2.

Editor

The Editor program (Listing 1) provides several basic functions for creating and maintaining source files for input to the Assembler program. Each function lets you have a printed copy of the source file being written or read. This program must be used when creating or editing files, since the Editor makes several checks to save running time of the Assembler program. Also, the Assembler expects to see the source lines in a specific format in the input file. The Editor also provides a means of printing program files saved on disk.

Creating Source Files

The Create function produces an original source file from data entered at the keyboard. Each line of source code consists of from one to four fields: label, command, operand and comment. The label, operand and comment fields are optional but each line must have a command before it will be accepted by the Editor.

One exception to this is a full-line comment that starts with an asterisk (*). The Editor will not allow entry of more than a given number of characters in each field, and any illegal characters will be ignored. A comma (,),

Robert W. Baker (15 Windsor Drive, Atco, NJ 08004) authors Microcomputing's *PET-pourri column.*

colon (:) or quote (") cannot be used in any field due to PET handling of data files and these special characters.

Labels must start with a letter, but the remaining characters may be letters or numbers. A label cannot be longer than six characters in length. The command is either an instruction mnemonic with the appropriate address suffix or an assembler directive. The maximum length of this field is five characters. The operand field contains the instruction operand (if required), and must be 13 characters or less. See the Assembler description for more information on the format and syntax of the command and operand fields.

The comment field lets you include a 25-character comment in any line. Characters may be any alphanumeric or graphics character, except for the above-mentioned BASIC restrictions. For added convenience, you can enter a full-line comment of up to 50 characters instead of the regular four fields by typing an asterisk as the first character of the line.

Each source line will be displayed as two lines, with a blank line between them for a pointer. The current line number will be indicated as a prompt for input. The label, command and operand fields will be on the top line, with the comment on a separate line. A full-line comment will wrap from the top to the bottom line when exceeding the limit of the first line. An up-arrow pointer will indicate the current position on the line at all times when input can be accepted. If you select the print option, each line will be printed when it is written to the output file.

Once the Create function has been selected, the following controls are provided by the appropriate keys:

- The space bar moves the pointer to the first character position of the next field. A space typed in any comment field will be entered as a space character in that field and will have no other effect.
- A shift-space combination returns the pointer to the first character position of the current field. If the pointer is already at the first character position, it will step to the first character position of the previous field.
- The return key enters the current line if valid (i.e., a command is present or it is a full-line comment).
- A shift-return combination discards the current line, removes the line number from the line currently

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```
LOC   -OBJECT-  LINE  ..... SOURCE CODE ..... < DASM V3.0 >

                 1  *
                 2  * SAMPLE ADDRESSING MODES
                 3  *
0000  6D 34 12   4          ADC    $1234          ABSOLUTE
0003  69 78      5          ADC#   $5678          IMMEDIATE; TAKES LOW BYTE
0005  65 01      6          ADCZ   1             ZERO PAGE
0007  71 02      7          ADC@Y  2             INDIRECT INDEXED; REG Y
0009  61 03      8          ADC@X  3             INDEXED INDIRECT; REG X
000B  75 04      9          ADCZX  4             ZERO PAGE INDEXED; REG X
000D  B6 05     10          LDXZY  5             ZERO PAGE INDEXED; REG Y
000F  6C 06     11          JMP@   6             INDIRECT
0011  D8        12          CLD                  IMPLIED...
0012  0A        13          ASLA                 ACCUMULATOR
0013  F0 01     14          BEQ    *+1           RELATIVE
0015  7D CD AB  15          ADCX   $ABCD         ABSOLUTE INDEXED; REG X
0018  79 00 04  16          ADCY   1024          ABSOLUTE INDEXED; REG Y
                17  *
                18  * OPERANDS & EXPRESSIONS
                19  *
                20  TAG     =      'A            ASCII LITERAL
                21  TAG2    =      'XYZ          ASCII LITERAL; 1ST CHAR
                22  ABC     =      1+$24         DEC+HEX#'S
                23  X2G     =      150/11        DIVISION
001B  F0 04     24          BEQ    *+4           RELATIVE BRANCH
001D  D0 F8     25          BNE    *-8
                26  YYY     =      'B+128        ASCII LITERAL + DEC#
                27  T2      =      -1            NEGATIVE NUMBER 2'S COMP
                28  T3      =      T2-2          SUBTRACT
                29  *
                30  * ASSEMBLER ERRORS
                31  *
                32          XXX                  BAD COMMAND/OPERAND
****  INVALID...                  └ COMMAND
001F  00 00     33          ASL@X                BAD ADDRESSING MODE
****  INVALID...                    └ ADR'NG MODE
0021  F0 00     34          BEQ    *+200         INVALID BRANCHES...
****  INVALID...                    └ BRANCH
0023  D0 00     35          BNE    *-200
****  INVALID...                    └ BRANCH
                36  TS      =      $XYZ          BAD OPERAND
****  INVALID...                    └ OPERAND
                37  TS      =      1000          DUPLICATE SYMBOL
                38  TS      =      123           2ND DUPLICATE


      SYMBOL      HEX--VALUE--DECIMAL

      ABC           0025           37
      T2            FFFF        65535
      T3            FFFD        65533
      TAG           0041           65
      TAG2          0058           88
      TS            03E8         1000
      ******   MULTIPLE DEFINITION
      X2G           000D           13
      YYY           00C2          194

      6  ERRORS
```

Sample listing.

Listing 1. DASM-Editor in PET BASIC.

```
10 REM ******* DASM -- EDITOR ********
20 REM *                            *
30 REM *    BY:  ROBERT BAKER       *
40 REM *                            *
50 REM ***** V1.2 **** 08/01/81 *****
60 :
70 :
80 PRINT"■";SPC(8);"■D A S M   E D I T O R"
90 CLR:U$="■──────────────────────────────────────────────────────────────────────┐
100 B$="                                                                        "
110 Q$(1)="■CREATE■":Q$(2)="■ EDIT ■":Q$(3)="■ COPY ■":Q$(4)="■ READ ■"
120 Q$(5)="■PRINT ■":Q$(6)=Q$(5)
130 OPEN 15,8,15:CR$=CHR$(13):PRINT U$
140 PRINT"   0  -  ■ DONE ":PRINT
150 PRINT"   1  -  ";Q$(1);" ─── NEW SOURCE FILE":PRINT
160 PRINT"   2  -  ";Q$(2);" ──┐":PRINT SPC(18);"├─ OLD SOURCE FILE"
170 PRINT"   3  -  ";Q$(3);" ──┤":PRINT SPC(18);"|"
180 PRINT"   4  -  ";Q$(4);" ──┤":PRINT SPC(18);"|"
190 PRINT"   5  -  ";Q$(5);" ──┘":PRINT
200 PRINT"   6  -  ";Q$(6);" ─── LISTING FILE"
210 PRINT U$:PRINT"SELECT DESIRED FUNCTION: ";
220 GOSUB 2610:F=V:IF R$="0" THEN PRINT"■":END
230 IF F<1 OR F>6 THEN 220
240 GOSUB 2250:IF F>4 THEN GOSUB 2310
250 IF F>3 THEN 270
260 PRINT"DO YOU WANT A PRINTED COPY";:GOSUB 2630:IF A=89 THEN GOSUB 2310
270 ON F GOTO 310,1540,1810,2080,2080,1970
280 REM ======================
290 REM CREATE NEW SOURCE FILE
```

More →

displayed and allows restarting the line by displaying a new line prompt with the same line number.

- The clear/home key terminates the source file and discards the current line if anything has been typed but not entered with the return key.
- The cursor left/right key moves the pointer left or right within the bounds of the current field: The pointer cannot be moved past the existing characters in the field or the next space after the last character.
- The insert key lets you insert a character before the character being pointed to. Once the insert key has been pressed, a character must be typed and entered, or shift-return typed to discard the line. Insert cannot be used to exceed the maximum number of characters within a specific field.
- Pressing delete deletes the character currently pointed to.

Note that the cursor up/down and reverse keys are ignored.

Editing Source Files

The Editor lets you edit a source file while copying it to a new output file. The Editor will keep a copy of the original source file as a backup copy, in case there are any system errors. If you pick the print option, each line written to the new file will also be printed. When the first line of the original source file is displayed, select the desired edit mode from those available. At the end of the original input file, you can add lines to the end of the file. When you're done editing a file, the number of lines in the new file will be indicated.

- When editing the file line-by-line, each line is displayed a line at a time and may be edited as desired. All control functions may be used as described for the create function with the following differences:
- The shift-return combination will delete the current line and display the next line.
- The clear/home key will display the current line and return to select another edit mode at that point.
- The insert-line(s)-before-the-current-line feature allows adding new lines of source code before the current line, exactly as when creating a new source file. When clear/home is typed, the current line will be displayed and you can select another edit mode as desired.
- Copy-from-one-line-to-another-line copies selected lines to the new file without change while each line is dis-

Listing 1 continued.

```
300 REM ======================
310 GOSUB 2320:FL$=FL$+".SRC"
320 OPEN 2,8,2,DR$+":"+FL$+",S,W":GOSUB 2440:IF EN THEN 2210
330 GOSUB 2250
340 N=1
350 L$="":C$=L$:O$=L$:T$=O$:GOSUB 2470
360 REM ===========
370 REM LABEL FIELD
380 REM ===========
390 PRINT:PRINT"□";TAB(7);:C=1
400 GOSUB 2660:IF C=1 AND A=42 THEN 1090
410 IF A=32 THEN 600
420 S$=L$:IF (A>64) AND (A<91) THEN 550
430 IF (C>1) AND (A>47) AND (A<58) THEN 550
440 IF A=160 OR B=17 THEN 390
450 IF B=13 OR B=19 THEN 1370
460 IF A=157 THEN GOSUB 2710
470 IF A=29 THEN GOSUB 2690
480 T=6:IF A=20 THEN GOSUB 2730:GOTO 560
490 IF (A<>148) OR (LEN(L$)>5) THEN 400
500 GOSUB 2770
510 GOSUB 2660:IF A=141 OR B=19 THEN 1370
520 IF (A>64) AND (A<91) THEN 540
530 IF (C=1) OR (A<48) OR (A>59) THEN 510
540 GOSUB 2820:GOTO 560
550 IF C<7 THEN GOSUB 2540
560 L$=S$:GOTO 400
570 REM =============
580 REM COMMAND FIELD
590 REM =============
600 PRINT TAB(15);:C=1
610 GOSUB 2660:IF A=32 THEN 750
620 S$=C$:IF (A>32) AND (A<96) AND (C<6) THEN GOSUB 2540:GOTO 710
630 IF (B=17) OR (C=1 AND A=160) THEN 390
640 IF A=160 THEN PRINT:PRINT "□";:GOTO 110
650 IF B=13 OR B=19 THEN 1370
660 IF A=157 THEN GOSUB 2710
670 IF A=29 THEN GOSUB 2690
680 T=14:IF A=20 THEN GOSUB 2730:GOTO 710
690 IF (A<>148) OR (LEN(C$)>4) THEN 610
700 GOSUB 2790:IF A=141 OR B=19 THEN 1370
710 C$=S$:GOTO 610
720 REM ==============
730 REM OPERAND FIELD
740 REM ==============
750 PRINT TAB(23);:C=1
760 GOSUB 2660:IF A=32 THEN PRINT:PRINT:GOTO 910
770 S$=O$:IF (A>32) AND (A<96) AND (C<14) THEN GOSUB 2540:GOTO 870
780 IF C=1 AND A=160 THEN PRINT:PRINT"□";:GOTO 600
790 IF A=160 THEN PRINT:PRINT"□";:GOTO 750
800 IF B=17 THEN 390
810 IF B=13 OR B=19 THEN 1370
820 IF A=157 THEN GOSUB 2710
830 IF A=29 THEN GOSUB 2690
840 T=22:IF A=20 THEN GOSUB 2730:GOTO 870
850 IF (A<>148) OR (LEN(O$)>12) THEN 760
860 GOSUB 2790:IF A=141 OR B=19 THEN 1370
870 O$=S$:GOTO 760
880 REM =============
890 REM COMMENT FIELD
900 REM =============
910 PRINT TAB(7);:C=1
920 GOSUB 2660:IF C=1 AND A=160 THEN PRINT:PRINT"□□□";:GOTO 750
930 IF A=160 THEN PRINT:PRINT"□";:GOTO 910
940 S$=T$:IF (B>31) AND (B<96) AND (C<26) THEN GOSUB 2540:GOTO 1050
950 IF B=17 THEN PRINT"□□";:GOTO 390
960 IF B=13 OR B=19 THEN 1380
970 IF A=157 THEN GOSUB 2710
980 IF A=29 THEN GOSUB 2690
990 T=6:IF A=20 THEN GOSUB 2730:GOTO 1050
1000 IF (A<>148) OR (LEN(T$)>24) THEN 920
1010 GOSUB 2770
1020 GOSUB 2660:IF A=141 OR B=19 THEN 1380
1030 IF (B<32) OR (B>95) THEN 1020
1040 GOSUB 2820
1050 T$=S$:GOTO 920
1060 REM =================
1070 REM FULL LINE COMMENT
1080 REM =================
1090 IF L$+C$+O$+T$<>"" THEN 400
1100 L$=R$:PRINT R$;
1110 PRINT TAB(9);:C=1
1120 GOSUB 2660:S$=T$:IF ((B>32) AND (B<96)) OR A=32 THEN 1330
1130 IF B=13 OR B=19 THEN 1370
1140 IF A<>157 THEN 1170
1150 IF C=32 THEN PRINT:PRINT"□□□□":PRINT TAB(39);:C=C-1:GOTO 1120
1160 GOSUB 2710:GOTO 1120
1170 IF A=29 AND C<LEN(T$)+1 THEN GOSUB 2700:GOTO 1350
1180 IF A<>160 AND B<>17 THEN 1210
1190 PRINT:PRINT"□";:IF C>30 THEN PRINT"□□";
1200 GOTO 1110
1210 IF (A<>148) OR (LEN(T$)>49) THEN 1280
1220 IF C>31 THEN PRINT " ";MID$(T$,C):PRINT "□";TAB(C-23);:GOTO 1250
1230 PRINT " ";MID$(T$,C,31-C);TAB(70);" ":PRINT TAB(9);MID$(T$,31)
1240 PRINT"□□□";TAB(8+C);
1250 GOSUB 2660:IF A=141 OR B=19 THEN 1370
1260 IF (B<32) OR (B>95) THEN 1250
1270 S$=T$:GOSUB 2750:W$=MID$(T$,C):T$=S$+W$:GOSUB 2700:GOTO 1120
1280 IF (A<>20) OR (C>LEN(T$)) THEN 1120
1290 IF C>31 THEN PRINT MID$(T$,C+1);" ":PRINT "□";TAB(C-23);:GOTO 1320
1300 PRINT MID$(T$,C+1,32-C);" ";TAB(70);" ":PRINT TAB(9);MID$(T$,33);" "
1310 PRINT "□□□";SPC(8+C);
```

More

played and possibly printed. If no number is entered and return is pressed, only the current line will be copied. By entering the keyword END, the input file will be copied to the end of the file.

- The delete-from-one-line-to-another-line mode is similar to the copy mode except it deletes the lines and displays the remaining lines.

Copying Source Files

This function of the Editor copies existing source files unchanged. Each line is displayed, and possibly printed. Multiple files can be copied and concatenated into one new source file. At the end of each file copied, the total number of lines in the new file will be displayed.

Reading and Printing Source Files

This function reads an existing source file and displays and/or prints each line as it is read. Hitting any key on the keyboard except clear/home or run/stop will alternately stop and start the function to let you hold various sections for closer examination. Hitting clear/home will terminate the function and return to the function menu after closing the input file. If you are not using a Commodore printer you may have to modify the print routines for them to function properly. If a printer is not used, just answer N for no when asked for a print option at the start of the Editor. In this way, all printing will be bypassed automatically.

Printing Saved Listing Files

This function simply prints the saved listing file on the printer as read from the disk file.

Assembler

The Assembler program (Listing 2) is a simple two-pass assembler that reads the source files generated by the Editor program and generates a standard PET program file on disk. It also provides a printed assembly listing complete with a symbol table that can optionally be saved onto disk for documentation purposes and so on.

On the first pass, the Assembler builds the symbol table while defining each label and computing its value. The symbols are displayed as they are defined to give you feedback on how the first pass is progressing. The symbol table is currently limited to 100 symbols. This limit may be changed by modifying the value of SZ in line 100. If the symbol table limit is

reached, or the amount of free memory space is less than 100 bytes, an error message will be displayed and the first pass will be ended.

If any I/O errors are encountered while reading the input files, an error message is displayed indicating the status code (ST) and/or disk error. Assembly will be terminated after reporting any fatal error of this type.

During the second pass, the source file is read again while the program file is written to disk. An assembly-language listing may also be printed or can be written to disk. The program file produced can then be loaded into the PET like any other program, since it uses the standard PET file formats. However, because of this, the program must be one contiguous block without any *holes*.

The printed listing produced by the Assembler will indicate the memory location and object in hexadecimal, the source file line number and the original line of source code consisting of label, command, operand and comment. The line number corresponds directly with the line numbers displayed by the Editor when editing the source file. Therefore, these numbers can be used to readily locate specific lines when editing from printed assembly or source file listings.

The Assembler expects the format of each line of code in the source file to contain four fields: an optional label, a mandatory command, an optional operand and a comment. Alternately, a line may be a full-line comment if the first character of the line is an asterisk.

Labels can be one to six characters in length. The first character must be a letter while any remaining characters may be letters or numbers. The value of any label will be the address of the next byte of memory defined by the command or the value assigned to the label via an Assembler directive. All label values are computed as unsigned 16-bit values and maintained as such within the symbol table. If any label is multiply defined, the first definition will be used and all duplicate definitions will be indicated in the symbol table. These errors will also be included in the error count shown at the end of the assembly.

The command will consist of either an instruction mnemonic followed by the appropriate addressing suffix or one of the available Assembler directives. Instruction mnemonics are the standard mnemonics used by MOS Technology. To speed assembly

Listing 1 continued.

```
1320 S$=T$:R$=MID$(T$,C+1):GOSUB 2750:T$=S$:GOTO 1120
1330 IF C>50 THEN 1120
1340 GOSUB 2540
1350 IF C=32 THEN PRINT:PRINT SPC(9);
1360 T$=S$:GOTO 1120
1370 IF C<32 THEN PRINT:PRINT
1380 PRINT:PRINT:IF A=141 OR B=19 THEN 1410
1390 IF L$="*" OR C$<>"" THEN GOSUB 2380:GOSUB 2420:GOTO 1450
1400 PRINT"■■■■";:GOTO 390
1410 PRINT"■■■■>>>■■■■":IF B<>19 THEN 1450
1420 IF M THEN 1610
1430 C$=".END":L$="":O$=L$:T$=O$:GOSUB 2430:IF M=0 THEN GOSUB 2680
1440 GOTO 2210
1450 IF M<>1 THEN 1490
1460 GOSUB 2560:IF E THEN 1770
1470 GOSUB 2500:PRINT"■■■■";:IF L$="*" THEN 1110
1480 GOTO 390
1490 IF A<>141 THEN N=N+1
1500 GOTO 350
1510 REM =========
1520 REM EDIT FILE
1530 REM =========
1540 GOSUB 2320:E=0
1550 PRINT#15,"S"+DR$+":"+FL$+".BAK":INPUT#15,EN
1560 PRINT#15,"R"+DR$+":"+FL$+".BAK="+DR$+":"+FL$+".SRC"
1570 GOSUB 2440:IF EN THEN 2210
1580 OPEN 1,8,2,DR$+":"+FL$+".BAK,S,R":GOSUB 2440:IF EN THEN 2210
1590 OPEN 2,8,3,DR$+":"+FL$+".SRC,S,W":GOSUB 2440:IF EN THEN 2210
1600 GOSUB 2560:IF E THEN 1770
1610 M=0:GOSUB 2250:GOSUB 2490:PRINT U$:PRINT"   1 - EDIT LINE BY LINE":PRINT
1620 PRINT"   2 - INSERT LINE(S) BEFORE THIS LINE":PRINT
1630 PRINT"   3 - COPY FROM THIS LINE TO LINE#":PRINT
1640 PRINT"   4 - DELETE FROM THIS LINE TO LINE#":PRINT U$
1650 PRINT"SELECT DESIRED EDITING MODE: ";
1660 GOSUB 2610:M=V:IF V<1 OR V>4 THEN 1660
1670 GOSUB 2250:ON M GOTO 1470,340
1680 GOSUB 2500:PRINT U$:IF M=3 THEN PRINT"COPY";
1690 IF M=4 THEN PRINT"DELETE";
1700 PRINT" FROM THIS LINE TO .....■":PRINT"(END = END OF INPUT FILE)":PRINT
1710 PRINT"LINE#  ";N:PRINT"■";SPC(6);
1720 INPUT R$:L=VAL(R$):IF R$="END" THEN L=1E5
1730 GOSUB 2250:IF L<N THEN 1680
1740 IF M=3 THEN PRINT"COPY";
1750 IF M=4 THEN PRINT"DELET";
1760 PRINT"ING LINE(S) .....":PRINT:PRINT:GOTO 1880
1770 GOSUB 2250:PRINT"END OF ORIGINAL INPUT FILE":GOSUB 2680
1780 PRINT"WANT TO ADD ADDITIONAL LINES";
1790 GOSUB 2630:M=0:IF A=78 THEN M=2:GOTO 1430
1800 N=Z+1:GOSUB 2250:GOTO 350
1810 PRINT:INPUT"NEW OUTPUT MODULE NAME   ■■■■";FL$:IF FL$="■" THEN 1810
1820 GOSUB 2350:OPEN 2,8,3,DR$+":"+FL$+".SRC,S,W":GOSUB 2440:IF EN THEN 2210
1830 GOSUB 2250:E=0:N=0
1840 PRINT:INPUT"INPUT MODULE NAME    ■■■■";FL$:IF FL$="■" THEN 1840
1850 GOSUB 2350:OPEN 1,8,2,DR$+":"+FL$+".SRC,S,R":GOSUB 2440:IF EN THEN 2210
1860 GOSUB 2250:PRINT"COPYING FILE.....":PRINT:PRINT
1870 GOSUB 2560:IF E THEN 1910
1880 IF M<4 THEN GOSUB 2380:GOSUB 2420
1890 IF M AND (N=L) THEN 1600
1900 GOTO 1870
1910 IF M THEN 1770
1920 CLOSE 1:GOSUB 2440:IF EN THEN 2210
1930 GOSUB 2680:PRINT"COPY ANOTHER FILE";
1940 GOSUB 2630:IF A=78 THEN GOSUB 2420:GOTO 2210
1950 GOTO 1830
1960 REM ==================
1970 REM PRINT LISTING FILE
1980 REM ==================
1990 GOSUB 2320:FL$=FL$+".LST"
2000 OPEN 1,8,4,DR$+":"+FL$+",S,R":GOSUB 2440:IF EN THEN 2210
2010 GOSUB 2250:PRINT:PRINT"PRINTING FILE.....":PRINT
2020 INPUT#1,L$:GOSUB 2440:IF EN>0 OR L$=".END" THEN 2210
2030 IF LEFT$(L$,1)="." THEN L$=" "+MID$(L$,2)
2040 PRINT#4,L$:GOTO 2020
2050 REM =========
2060 REM READ FILE
2070 REM =========
2080 GOSUB 2320:FL$=FL$+".SRC"
2090 E=0:OPEN 1,8,2,DR$+":"+FL$+",S,R":GOSUB 2440:IF EN THEN 2210
2100 GOSUB 2250:IF F=5 THEN PRINT:PRINT"PRINTING FILE.....":PRINT
2110 GOSUB 2570:IF E THEN 2170
2120 IF F=4 THEN GOSUB 2500
2130 GOSUB 2380:GET R$:IF R$="" THEN 2110
2140 IF (ASC(R$) AND 127)=19 THEN PRINT U$:GOTO 2210
2150 GOSUB 2600:IF F=5 THEN 2100
2160 GOTO 2110
2170 IF F=4 THEN GOSUB 2600
2180 REM ============================
2190 REM CLOSE ALL FILES AND RESTART
2200 REM ============================
2210 CLOSE 1:CLOSE 2:CLOSE 4:CLOSE 15:GOTO 80
2220 REM ============================
2230 REM ****** SUBROUTINES *******
2240 REM ============================
2250 PRINT"■";Q$(F);:IF M=0 THEN PRINT:GOTO 2300
2260 PRINT"  -  ";:IF M=1 THEN PRINT"LINE BY LINE"
2270 IF M=2 THEN PRINT"INSERT"
2280 IF M=3 THEN PRINT"COPY"
2290 IF M=4 THEN PRINT"DELETE"
2300 PRINT U$:RETURN
2310 P=1:OPEN 4,4:RETURN
2320 PRINT:INPUT"MODULE NAME   ■■■■";FL$
2330 IF FL$="■" THEN 2320
```

More →

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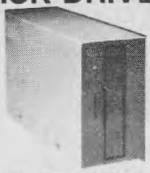

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Listing 1 continued.

```
2340 FL$=LEFT$(FL$,12)
2350 PRINT:PRINT"DRIVE# 8 OR 1: ";
2360 GET DR$:IF DR$<>"8" AND DR$<>"1" THEN 2360
2370 PRINT DR$:RETURN
2380 IF P=0 THEN RETURN
2390 PRINT#4,SPC(6-LEN(STR$(N)));N;SPC(2);
2400 IF L$="*" THEN PRINT#4,"* ";T$:RETURN
2410 PRINT#4,L$;SPC(8-LEN(L$));C$;SPC(7-LEN(C$));O$;SPC(15-LEN(O$));T$:RETURN
2420 Z=Z+1
2430 PRINT#2,L$;",";C$;",";O$;",";T$;CR$;
2440 INPUT#15,EN$,EM$,ET$,ES$:EN=VAL(EN$):IF EN=0 THEN RETURN
2450 GOSUB 2250:PRINT"■DISK ERROR!■■":PRINT EN$;" ";EM$,ET$;" ";ES$
2460 PRINT:PRINT:GOTO 2600
2470 V=4:IF M=2 THEN PRINT"■■";:V=3
2480 PRINT RIGHT$("    "+STR$(N),V);"■>";:RETURN
2490 L$=L1$:C$=C1$:O$=O1$:T$=T1$:N=N1
2500 GOSUB 2470:PRINT TAB(7);L$;
2510 IF L$<>"*" THEN 2530
2520 PRINT" ";LEFT$(T$,31);TAB(50);" ":PRINT TAB(9);MID$(T$,32):PRINT:RETURN
2530 PRINT TAB(15);C$;TAB(23);O$:PRINT:PRINT TAB(7);T$:PRINT:RETURN
2540 IF C>LEN(S$) THEN S$=S$+R$:GOTO 2700
2550 W$=MID$(S$,C+1):GOSUB 2750:S$=S$+W$:GOTO 2700
2560 GOSUB 2570:N1=N:L1$=L$:C1$=C$:O1$=O$:T1$=T$:RETURN
2570 INPUT#1,L$,C$,O$,T$:GOSUB 2440
2580 IF C$=".END" THEN E=1 RETURN
2590 N=N+1:RETURN
2600 PRINT"■       DEPRESS ANY KEY TO CONTINUE       "
2610 GET R$:IF R$="" THEN 2610
2620 V=VAL(R$):A=ASC(R$):B=(A AND 127):RETURN
2630 PRINT" (Y/N): ";
2640 GOSUB 2610:IF A<>89 AND A<>78 THEN 2640
2650 PRINT R$:PRINT U$:RETURN
2660 PRINT"■M■";:GOSUB 2610:PRINT" ■□";:IF A=34 OR A=44 OR A=58 THEN 2660
2670 RETURN
2680 PRINT:PRINT"NEW FILE =";Z;"LINES":PRINT U$:RETURN
2690 IF C>LEN(S$) THEN RETURN
2700 C=C+1:PRINT R$;:RETURN
2710 IF C>1 THEN C=C-1:PRINT R$;
2720 RETURN
2730 IF C>LEN(S$) THEN RETURN
2740 R$=MID$(S$,C+1):PRINT R$;" ":PRINT"□";TAB(T+C);
2750 IF C>1 THEN S$=LEFT$(S$,C-1)+R$:RETURN
2760 S$=R$:RETURN
2770 W$=MID$(S$,C):PRINT" ";W$;
2780 PRINT:PRINT"□";TAB(T+C);:RETURN
2790 GOSUB 2770
2800 GOSUB 2660:IF A=141 OR B=19 THEN RETURN
2810 IF (A<33) OR (A>95) THEN 2800
2820 GOSUB 2750:S$=S$+W$:GOTO 2700
```

Listing 2. DASM-Assembler in PET BASIC.

```
10 REM ***** DASM - ASSEMBLER *******
20 REM *                           *
30 REM *      BY:   ROBERT BAKER    *
40 REM *                           *
50 REM ****  V3.0  **** 08/01/81 ****
60 :
70 :
80 PRINT"□"SPC(6)"■D A S M   A S S E M B L E R"■PRINT:PRINT:PRINT
90 CLR:CR$=CHR$(13)
100 SZ=100:DIM S$(SZ),V(SZ)
110 PRINT:INPUT"MODULE NAME   ■■■■";FL$
120 IF FL$="■" THEN 110
130 PRINT:PRINT"DRIVE# 8 OR 1: ";
140 GET DR$:IF DR$<>"8" AND DR$<>"1" THEN 140
150 PRINT DR$:FL$=LEFT$(FL$,12):OPEN 15,8,15
160 PRINT#15,"S"+":"+FL$:INPUT#15,EN
170 GOSUB 1490
180 OPEN 2,8,3,DR$+":"+FL$+",P,W":GOSUB 1510
190 PRINT:PRINT"LISTING TO DISK (D) OR PRINTER (P): ";
200 GET PR$:IF PR$<>"D" AND PR$<>"P" THEN 200
210 PRINT PR$:IF PR$="P" THEN OPEN4,4:LE$=CHR$(13)+CHR$(10):LS$=" ":GOTO 270
220 PRINT#15,"S"+DR$+":"+FL$+".LST":INPUT#15,EN
230 OPEN 4,8,4,DR$+":"+FL$+".LST,S,W":GOSUB 1510:LE$=CHR$(13):LS$="."
240 REM ================================
250 REM FIRST PASS, GENERATE SYMBOL TABLE
260 REM ================================
270 PRINT"□FIRST PASS - DEFINING SYMBOLS":PRINT:PRINT
280 GOSUB 1500:IF L$<"A" THEN 350
290 PRINT L$,
300 IF S=SZ OR FRE(0)<100 THEN PRINT"■SYMBOL TABLE OVERFLOW":GOTO 440
310 S=S+1:S$(S)=L$:IF C$<>"=" THEN 340
320 GOSUB 1160:V(S)=N:IF N<0 THEN S=S-1
330 GOTO 280
340 V(S)=P
350 IF C$>"@" THEN GOSUB 1100:GOTO 280
360 IF C$<>"*=" THEN 410
370 IF P>0 THEN 280
380 GOSUB 1160:IF N > -1 THEN P=N
390 IF L$<>"" THEN V(S)=P
400 GOTO 280
410 IF C$=".BY" THEN P=P+1
420 IF C$=".ADR" THEN P=P+2
430 IF C$<>".END" THEN 280
440 CLOSE 1:GOSUB 1510:GOSUB 1490
450 REM ============================
```

More →

times, an addressing suffix is added to the mnemonic rather than being encoded into the operand. The following table lists the suffixes used for each addressing mode:

blank	Absolute, implied or relative
A	Accumulator
#	Immediate
@	Indirect
Z	Zero page
X	Absolute indexed—register X
Y	Absolute indexed—register Y
@X	Indexed indirect—register X
@Y	Indirect indexed—register Y
ZX	Zero page indexed—register X
ZY	Zero page indexed—register Y

Only four Assembler directives are available—mainly to keep the assembly times as short as possible. The functions include:

- .ADR *n*, which defines a two-byte address constant in standard address format; low-order eight bits, high-order eight bits.
- .BY *n*, which defines a one-byte constant of the value *n*. If *n* is greater than 255, then the byte will be the low-order eight bits (one byte) of the binary value specified.
- LABEL=*n*, which defines a symbolic label with the value *n*. A label must be specified and the value *n* must be previously defined in the first pass of the assembly.
- *=*n*, which sets the program counter to the value specified, as a 16-bit quantity. If a label is specified, it will be assigned the same value as *n*, the first byte of the new area of memory. The value of *n* must be previously defined in the first pass. This command must be used prior to assembling any actual instructions, if it is to be used at all. This is because the program file being produced must be a contiguous block of code with a known starting address. The default address is zero if none is specified.

Instruction and Assembler directive operands may be specified in a number of formats, shown in Table 1. In addition, three operators are allowed within simple expressions using any of the above formats (decimal, hexadecimal, etc.) for each value in the expressions shown in Table 2.

All operands are computed as 16-bit quantities. If a command only requires an eight-bit quantity (such as a load accumulator immediate instruction), only the low order eight bits of the operand value will be used.

Comments in an instruction line may be up to 25 characters long, and

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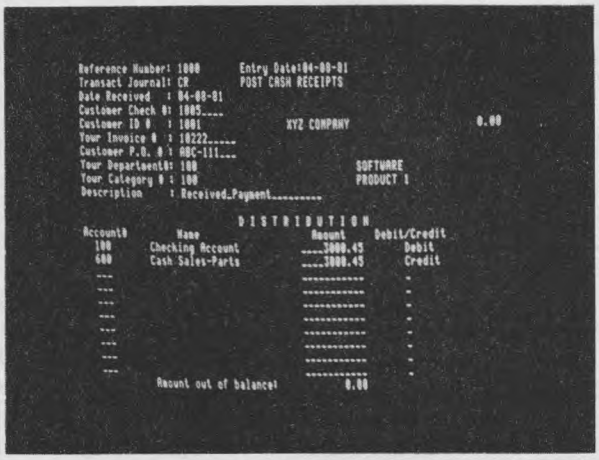

Typical screen format - actual photograph.

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Listing 2 continued.

```
460 REM SECOND PASS, GENERATE OBJECT
470 REM ============================
480 PRINT"□SECOND PASS - LISTING/OBJECT"
490 L=0:PS=0:P=0:EN=0:M$="....."
500 PRINT#4,"LOC   -OBJECT-  LINE  ";M$;M$;
510 PRINT#4," SOURCE CODE ";M$;M$;M$;" < DASM V3.0 >";LE$;
520 PRINT#4,LS$;"  ";LE$;
530 E=0:B$="":GOSUB 1500:L=L+1:N$=STR$(L):IF L$="" THEN 560
540 IF L$="*" THEN PRINT#4,LS$;SPC(19-LEN(N$));N$;"  * ";T$;LE$;:GOTO 530
550 IF C$  = "=" THEN 890
560 IF C$  > "@" THEN 670
570 IF C$ <> "*=" THEN 630
580 IF PF>0 THEN E=E+4:GOTO 900
590 GOSUB 1160:IF N<0 THEN E=E+2: GOTO 900
600 P=N:PS=P
610 GOSUB 620:GOTO 770
620 P1=INT(PS/256):PRINT#2,CHR$(PS-(P1*256));CHR$(P1);:PF=1:RETURN
630 PS=P:PB=3:IF C$= ".BY" THEN P=P+1:GOTO 730: REM <== 1-BYTE CONSTANT
640 IF C$ = ".ADR" THEN P=P+2: GOTO 730: REM <== 2-BYTE ADR CONSTANT
650 IF C$ = ".END" THEN 940
660 E=E+4: GOTO 900
670 PB=0:GOSUB 1100:I$=MID$(I$,5):IF PB=0 THEN E=E+4:GOTO 900
680 A$=LEFT$(A$+"  ",2)
690 IF LEFT$(I$,2)=A$ THEN 720
700 I$=MID$(I$,6):IF I$>"" THEN 690
710 E=E+8:X1=PS:GOTO 1450
720 N=VAL(MID$(I$,3,3)):GOSUB 1420:GOSUB 1460:B$=H2$+" ":IF PB=1 THEN 770
730 GOSUB 1160:IF N<0 THEN E=E+2:GOTO 1440
740 IF PB=2 THEN N=N-P:IF N>127 OR N < -128 THEN E=E+16:GOTO 1440
750 N1=INT(N/256):N2=N-(N1*256):GOSUB 1460:N=N2:GOSUB 1420:B$=B$+H2$+" "
760 IF P-PS=3 OR C$= ".ADR" THEN N=N1:GOSUB 1420:B$=B$+H1$
770 N=PS:GOSUB 1460:PRINT#4,H$;
780 PRINT#4,"  ";B$;SPC(14-LEN(B$)-LEN(N$));N$;"  ";L$;SPC(8-LEN(L$));C$;
790 PRINT#4,SPC(7-LEN(C$));O$;SPC(15-LEN(O$));T$;LE$;:IF E=0 THEN 530
800 REM ======================
810 REM FLAG ERRORS IN LISTING
820 REM ======================
830 PRINT#4,"****  INVALID...";SPC(14);
840 IF (E AND 2) THEN PRINT#4,SPC(7);"└ OPERAND";LE$;
850 IF (E AND 4) THEN PRINT#4," └ COMMAND";LE$;
860 IF (E AND 8) THEN PRINT#4,SPC(3);"└ ADR'NG MODE";LE$;
870 IF (E AND 16) THEN PRINT#4,SPC(7);"└ BRANCH";LE$;
880 EN=EN+1:GOTO 530
890 GOSUB 1160:IF N<0 THEN E=E+2
900 PRINT#4,LS$;SPC(3);:GOTO 780
910 REM ================================
920 REM PRINT SYMBOL TABLE & ERROR SUMMARY
930 REM ================================
940 IF S=0 THEN 1040
950 FOR X=1 TO 5:PRINT#4,LS$;"  ";LE$;:NEXT
960 PRINT#4,"SYMBOL      HEX--VALUE--DECIMAL";LE$;:PRINT#4,LS$"  ";LE$;
970 B$="":S$(0)="←":FOR E=1 TO S:P=0:FOR T=1 TO S:IF S$(T) < S$(P) THEN P=T
980 NEXT
990 IF B$<>S$(P) THEN 1010
1000 PRINT#4,"******   MULTIPLE DEFINITION";LE$;:EN=EN+1:GOTO 1030
1010 N=V(P):O$=STR$(N):GOSUB 1460:B$=S$(P)
1020 PRINT#4,B$;SPC(11-LEN(B$));H$;SPC(14-LEN(O$));O$;LE$;
1030 S$(P)="←":NEXT
1040 PRINT#4,LS$"  ";LE$;:PRINT#4,EN;" ERRORS";LE$;
1050 IF PR$="D" THEN PRINT#4,".END";LE$;
1060 PRINT"□ASSEMBLY COMPLETE, ";EN;"ERRORS":GOTO 1550
1070 REM ==============================
1080 REM ***** NESTED SUBROUTINES *****
1090 REM ==============================
1100 M$=LEFT$(C$,3):A$=MID$(C$,4)
1110 RESTORE:FOR N=1 TO 56:READ I$:IF M$<>LEFT$(I$,3) THEN NEXT:RETURN
1120 PS=P:PB=VAL(MID$(I$,4,1)):IF A$="" THEN P=P+PB:RETURN
1130 P=P+2:IF A$="X" OR A$="Y" THEN P=P+1:RETURN
1140 IF A$="A" THEN P=P-1:PB=1
1150 RETURN
1160 M$=O$:FOR X=1 TO LEN(O$):I$=MID$(O$,X,1)
1170 IF I$="+" OR I$="-" OR I$="/" THEN 1190
1180 NEXT:GOSUB 1300:RETURN
1190 N=0:A$=MID$(M$,X+1)
1200 IF X>1 THEN O$=LEFT$(M$,X-1):GOSUB 1300:IF N<0 THEN 1290
1210 N1=N:O$=A$:GOSUB 1300:IF N<0 THEN 1290
1220 O$=M$:IF I$= "+" THEN N2=N+N1
1230 IF I$= "-" THEN N2=N1-N
1240 IF I$= "/" THEN N2=INT(N1/N):IF LEFT$(M$,1)="/" THEN 1290
1250 N=N2
1260 IF N<0 THEN N=N+65536:GOTO 1260
1270 IF N>65535 THEN N=N-65536:GOTO 1270
1280 RETURN
1290 O$=M$:GOTO 1370
1300 IF O$ < "A" THEN 1330
1310 FOR X=0 TO S:IF S$(X)=O$ THEN N=V(X):RETURN
1320 NEXT:GOTO 1370
1330 IF LEFT$(O$,1)<>"$" THEN 1380
1340 N=0:FOR X=2 TO 6:H$=MID$(O$,X,1):IF H$="" THEN RETURN
1350 X1=VAL(H$):IF X1 OR H$="0" THEN N=N*16+X1:NEXT
1360 X1=ASC(H$):IF X1>64 AND X1<71 THEN N=N*16+(X1-55):NEXT
1370 N=-1:RETURN
1380 N=INT(VAL(O$)):IF N OR O$="0" THEN RETURN
1390 IF O$="*" THEN N=P:RETURN
1400 IF LEFT$(O$,1)="'" AND LEN(O$)>1 THEN N=ASC(MID$(O$,2)):RETURN
1410 GOTO 1370
1420 IF PF=0 THEN GOSUB 620
1430 PRINT#2,CHR$(N);:RETURN
1440 IF C$>"@" THEN X1=PS+1
1450 N=0:FOR X=1 TO P-X1:B$=B$+"00 ":GOSUB 1420:NEXT:GOTO 770
1460 H$="":FOR X=3 TO 0 STEP-1:X1=INT(N/(16↑X)):N=N-(X1*(16↑X))
1470 IF X1>9 THEN X1=X1+7
```

More →

any characters can be used (except as limited by the Editor due to handling of BASIC files with INPUT#). A full-line comment can be up to 50 characters long. Comment fields can contain graphics characters if desired.

Any assembly errors will be indicated in the printed assembly listing with an error line indicating the field in error. At the end of the assembly, the total number of errors will be indicated. Also, a sorted symbol table will be at the end of the assembly listing indicating the defined value of each symbol in both hexadecimal and decimal form for your convenience.

Hints

The following are hints on effective use of the Editor/Assembler:

- Try to break up larger programs into smaller, logical pieces that can be assembled and tested separately. This allows quicker editing and assembling, when a program is repeatedly edited and assembled to correct bugs as they're detected.
- Define most commonly used symbols, constants and all working storage at the beginning of each program. Symbols and labels are entered into the symbol table in the order defined and searched sequentially in that same order for greatest assembler speed.
- Keep labels short to allow the maximum number of labels within the symbol table when writing larger programs.
- Watch the usage and length of comments as this can tremendously increase the read time of the source file during editing and assembling.
- Remember that line numbers in the printed assembly listing and source file listings correspond directly with the line numbers displayed by the editor when editing a source file. Therefore, they can be used to quickly locate a specific line when editing.
- The module name can be anything desired, with 12 characters maximum. A four-character suffix is automatically appended to identify the file type:

.SRC	Source file
.BAK	Backup source file automatically created when editing a source file
.LST	Listing file saved to disk

The name of the final program file generated by the assembler will be the module name with no suffix.

If you want to avoid typing in the two programs shown, I'll send a copy of both on a 4040 diskette (DOS 2.1) for $5 to cover my costs.■

Listing 2 continued.

```
1480 H$=H$+CHR$(X1+48):NEXT:H1$=LEFT$(H$,2):H2$=RIGHT$(H$,2):RETURN
1490 OPEN 1,8,2,DR$+":"+FL$+".SRC,S,R":GOTO 1510
1500 INPUT#1,L$,C$,O$,T$
1510 INPUT#15,EN$,EM$,ET$,ES$:IF EN$="00" THEN RETURN
1520 PRINT"DISK ERROR!":PRINT
1530 PRINT EN$;" ";EM$,ET$;" ";ES$
1540 PRINT:PRINT:PRINT"ASSEMBLY ABORTED":PRINT:PRINT
1550 CLOSE 1:CLOSE 2:CLOSE 4:CLOSE 15:END
1560 REM ======================================
1570 REM ******* INSTRUCTION DATA TABLE ********
1580 REM ======================================
1590 REM CONTAINS 56 ENTRIES, 1 PER INSTRUCTION
1600 REM EACH ENTRY CONSISTS OF:
1610 REM          3 CHARACTER MNEMONIC
1620 REM          1 DIGIT INSTRUCTION LENGTH
1630 REM MULTIPLE 5 CHARACTER EXTENSIONS FOR EACH
1640 REM            VALID ADDRESSING MODE-
1650 REM             2 CHARACTER MNEMONIC SUFFIX
1660 REM             3 DIGIT OPCODE VALUE
1670 REM A NULL ENTRY IS INCLUDED AT THE END OF
1680 REM THE TABLE.
1690 REM ======================================
1700 DATA "ADC3# 105  109Z 101@X097@Y113ZX117X 125Y 121"
1710 DATA "AND3# 041  045Z 037@X033@Y049ZX053X 061Y 057"
1720 DATA "ASL3  014Z 006A 010ZX022X 030","BCC2  144","BCS2  176"
1730 DATA "BEQ2  240","BIT3  044Z 036","BMI2  048","BNE2  208","BPL2  016"
1740 DATA "BRK1  000","BVC2  080","BVS2  112","CLC1  024","CLD1  216"
1750 DATA "CLI1  088","CLV1  184"
1760 DATA "CMP3# 201  205Z 197@X193@Y209ZX213X 221Y 217"
1770 DATA "CPX3# 224  236Z 228","CPY3# 192  204Z 196"
1780 DATA "DEC3  206Z 198ZX214X 222","DEX1  202","DEY1  136"
1790 DATA "EOR3#073  077Z 069@X065@Y081ZX085X 093Y 089"
1800 DATA "INC3  238Z 230ZX246X 254","INX1  232","INY1  200"
1810 DATA "JMP3  076@ 108","JSR3  032"
1820 DATA "LDA3# 169  173Z 165@X161@Y177ZX181X 189Y 185"
1830 DATA "LDX3# 162  174Z 166Y 190ZY182","LDY3# 160  172Z 164ZX180X 188"
1840 DATA "LSR3  078Z 070A 074ZX086X 094","NOP1  234"
1850 DATA "ORA3# 009  013Z 005@X001@Y017ZX021X 029Y 025","PHA1  072"
1860 DATA "PHP1  008","PLA1  104","PLP1  040","ROL3  046Z 038A 042ZX054X 062"
1870 DATA "ROR3  110Z 102A 106ZX118X 126","RTI1  064","RTS1  096"
1880 DATA "SBC3# 233  237A 229@X225@Y241ZX245X 253Y 249","SEC1  056"
1890 DATA "SED1  248","SEI1  120","STA3  141Z 133@X129@Y145ZX149X 157Y 153"
1900 DATA "STX3  142Z 134ZY150","STY3  140Z 132ZX148","TAX1  170"
1910 DATA "TAY1  168","TSX1  186","TXA1  138","TXS1  154","TYA1  152",""
```


↙See List of Advertisers on page 210

After making a ten-wire cable, you can interface the Quik Printer II to the PET 2001 using this short program that resides in the second cassette buffer.

TRS-80 Printer for the PET

By Joseph W. Verzino

The strongest feature of my TRS-80 system was its Quik Printer II. So when I sold the TRS-80 in favor of my PET 2001, I decided to keep the printer and interface it to the PET. Others might want to do the same, since the Quik Printer II is inexpensive—only $187.

I chose to use the parallel (user) port, because it is the simplest. I rejected the IEEE-488 port because it requires opening and closing files, and because the IEEE-488 commands complicate the problem. And most people are probably already using their memory expansion port.

First, I added a reset button. Programs in the second cassette buffer (033A-3FF hexadecimal, 826-1023 decimal) are retained when the reset button is activated, so I placed the Print Screen program there. BASIC programs reside in higher memory starting at 0400 (hexadecimal), and are erased on reset. A BASIC program and this Print Screen program can reside in memory concurrently.

I tried to use handshaking on the CA1 line, but I couldn't get a response from the busy line of the printer. Consequently, I had to do data rate matching on the CB2 strobe line and operate without handshaking. However, operation without handshaking has proven to be reliable.

To copy a program, you must list it on the screen about 22 lines at a time and type SYS (826) in the command mode. The Print Screen program will change each 40-character line into two 20-character lines, since the Quik Printer II only prints 32 characters per line.

The assembly listing of Print Screen (Listing 1) was obtained in this way. I first listed lines 826 through 870 on the screen, then used SYS(826) to have those lines printed out. This process was repeated for lines 872 through 907, 912 through 945 and 947 through 995. The program was being used to produce an assembly listing of itself. (Notice the change from one 40-character line to two 20-character lines for each line of the program.)

The Print Screen Program

I used the TIM monitor to display a hex dump of part of the Print Screen program (i.e., a hexadecimal listing of the contents of memory locations 0338 to 03E0). I then used the Print Screen program to list the hex dump on the Quik Printer II (see Listing 2). You can use the TIM monitor and load the Print Screen program by entering the hexadecimal values in Listing 2.

I used a program from *Micro* magazine ("A Simple 6502 Assembler for the PET" by Michael J. McCann, Aug.-Sept. 1978) to produce the assembled version of the Print Screen program, but I actually wrote the program directly in machine language. The assembled version is shown in Listing 1.

I used the PET 6522 versatile interface adapter (VIA), located from E840 (59456) to E84F (59471), to communicate with the Quik Printer. Output register A without handshaking, located at E84F (59471), contains the output logic. The peripheral-control register (PCR) at E84C (59468) gener-

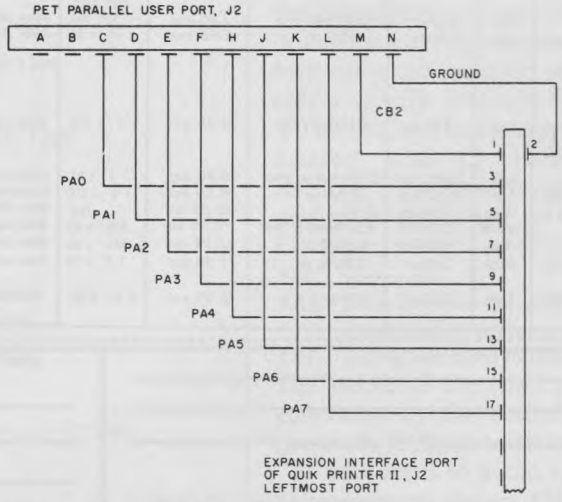

Fig. 1. Diagram of the ten connections that must be made from the parallel port of the PET to the expansion interface port of the Quik Printer II.

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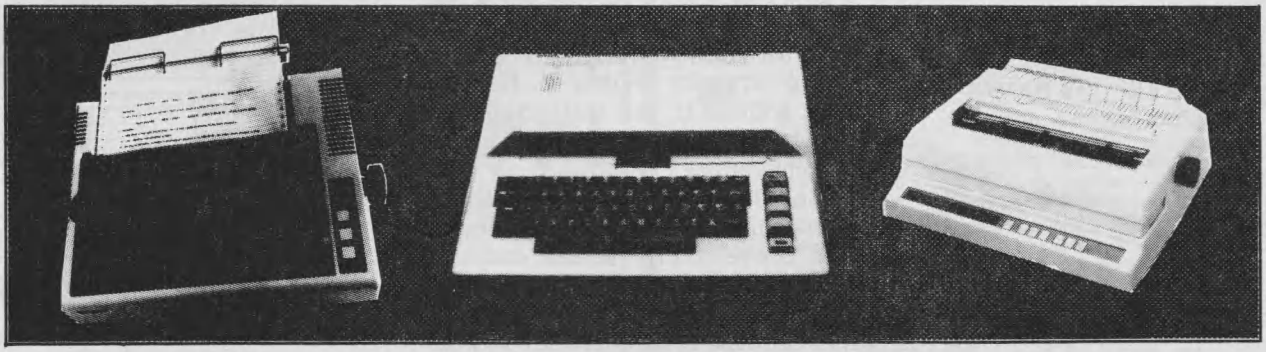

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Listing 1. Assembly-language listing of the Print Screen program. This listing was produced by using the Print Screen program on itself. Notice that it changes 40-character lines to two 20-character lines.

```
826 033A   A9 FF
LDAIM  255
828 033C   8D 43E8
STA    59459
831 033F   A0 00
LDYIM  0
833 0341   AD 4CE8
LDA    59468
836 0344   09 E0
ORAIM  224
838 0346   8D 4CE8
STA    59468
841 0349   20 B103
JSR    945
844 034C   A2 00
LDXIM  0
846 034E   B9 0080
LDAY   32768
849 0351   20 7C03
JSR    892
852 0354   20 D003
JSR    976
855 0357   C8
INY
856 0358   98
TYA
857 0359   C9 00
CMPIM  0
859 035B   D0 07
BNE    7
861 035D   20 9103
JSR    913
864 0360   C9 84
CMPIM  132
866 0362   F0 0C
BEQ    12
868 0364   E8
INX
869 0365   8A
TXA
870 0366   C9 14
CMPIM  20
872 0368   D0 E4
BNE    228
874 036A   20 B103
JSR    945
877 036D   4C 4C03
JMP    844
880 0370   A9 80
LDAIM  128
882 0372   8D 5003
STA    848
```

More →

ates CB2 pulsed strobe that is normally high, then pulsed low to print. In addition, I used the high-order byte of timer 2 at E849 (59465) in a fast-timer loop. The port A data-direction (PADD) register at E843 (59459) sets port A for output (FF).

Print Screen uses both the X and Y index registers as counters. Index register X is used to count from 0 to 19 (20 counts) for a half line, and index register Y is used to count the four pages of memory from 8000 to 83FF (actually, 1024 counts). Since the Y register is a single byte, it will only count 0 to 255 (256 bytes, one page), and then roll back to 00. For walking through the screen memory, absolute indexed addressing is used, incrementing the Y register by one on each pass. The high address byte is incremented by 1 on each rollover of the Y register (from FF to 00).

Interfacing my PET to the Quik Printer required some modifications.

Lines 826 and 828 set up port A for output. Line 831 initializes the Y index register to 0. Lines 833 to 838 set CB2 high. Line 841 jumps to the subroutine at line 945, which clears the printer buffer, outputs a carriage return and line feed, and sets up a one-half-second delay. Line 844 starts a new half-line by zeroing index register X. Line 846 loads the accumulator with a new character, absolute indexed on index register Y. It is the high address in this instruction (80) that is incremented on index register Y roll-over.

Line 849 calls a load output port subroutine at line 892. This subroutine converts PET screen codes to ASCII codes, adding decimal 64 to the letters for the conversion. Line 852 calls the print character subroutine, which supplies the timing and pulses the CB2 strobe line low. Lines 855 to 857 increment Y looking for Y register roll-over. With no roll-over (it only happens four times) the relative branch is to line 868. Lines 868 to 872 look for the end of half line (when index register X equals 20 decimal).

Out of 20 tries, 19 times the relative branch is back 28 locations to line

```
885 0375   8D 8303
STA    899
888 0378   8D 9003
STA    912
891 037B   60
RTS
892 037C   C9 20
CMPIM  32
894 037E   10 07
BPL    7
896 0380   EA
NOP
897 0381   B9 0080
LDAY   32768
900 0384   18
CLC
901 0385   69 40
ADCIM  64
903 0387   8D 4FE8
STA    59471
906 038A   60
RTS
907 038B   00
BRK
912 0390   00*
913 0391   AD 5003
LDA    848
916 0394   18
CLC
917 0395   69 01
ADCIM  1
919 0397   8D 8303
STA    899
922 039A   8D 5003
STA    848
925 039D   60
RTS
926 039E   EA
NOP
927 039F   EA
NOP
928 03A0   AD 49E8
LDA    59465
931 03A3   E9 E0
SBCIM  224
933 03A5   8D 9003
STA    912
936 03A8   AD 49E8
LDA    59465
939 03AB   ED 9003
SBC    912
942 03AE   30 F8
BMI    248
944 03B0   60
RTS
945 03B1   A9 0D
LDAIM  13
```

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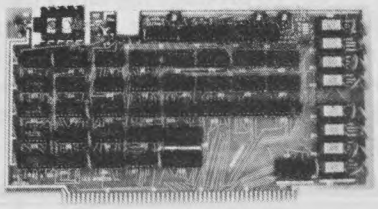

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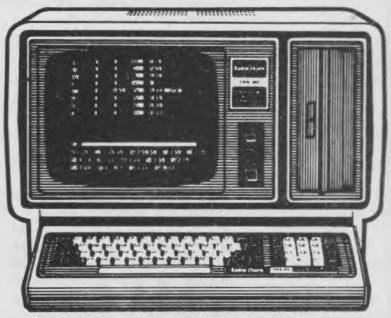

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Listing 1 continued.

```
947 03B3   8D 4FE8
STA    59471
950 03B6   20 D003
JSR    976
953 03B9   AD 0202
LDA    514
956 03BC   69 20
ADCIM  32
958 03BE   8D 9003
STA    912
961 03C1   AD 0202
LDA    514
964 03C4   ED 9003
SBC    912
967 03C7   30 F8
BMI    248
969 03C9   60
RTS
970 03CA   A0 03
LDYIM  3
972 03CC   20 A003
JSR    928
975 03CF   60
RTS
976 03D0   AD 4CE8
LDA    59468
979 03D3   29 AF
ANDIM  175
981 03D5   8D 4CE8
STA    59468
984 03D8   20 A003
JSR    928
987 03DB   09 E0
ORAIM  224
989 03DD   8D 4CE8
STA    59468
992 03E0   20 A003
JSR    928
995 03E3   60
RTS
```

846, loading the accumulator with the next character. On the 20th try, the program steps to line 874, which is a carriage return, line feed, one-half second delay. The program steps to line 877 and makes an unconditional jump to line 844, the start new half-line entry point. We return to the four roll-over conditions.

At line 861, only accessed at roll-over of index register Y, the program jumps to a subroutine at line 913, the increment page subroutine. This subroutine adds 1 to the high address byte at addresses 0350 (848) and 0383 (899), and leaves a copy of the high address byte in the accumulator. At line 864 the high address byte is compared to 84 hexadecimal. The first three times (81, 82 and 83), the program drops to line 868, again looking for the end of a half-line. On the fourth roll-over, the equality comes true in line 866, and the program branches forward 12 locations to line 880, and it's cleanup time before the exit.

Line 880 loads hexadecimal 80 in the accumulator. This value is then stored in 0350 (848) and 0383 (899) to reset the pointer to the start-of-screen. This value is also stored at 0390 (912), which is a temporary store location used to store samples of the two timers.

As a consequence of executing the cleanup routine (lines 880 to 888) before the return, the Print Screen program is identical before and after each execution of a SYS (826). This aids in the verification process when storing the program on tape. Lastly, line 906 is a return-from-subroutine RTS instruction, for branching control back to the calling program. It is this RTS instruction that lets you embed the SYS (826) statement in BASIC programs without losing continuity in the calling BASIC program (see Listing 2).

The Simple Connections

To communicate with the Quik Printer II, ten wires must be connected from the parallel port on the PET to the expansion interface port on the Quik Printer II. The ten wires carry the digital ground, CB2 (strobe line) and eight parallel data line (PA0 to PA7) signals (see Fig. 1).

Looking at the rear of the Quik Printer II, the left-most vertical port is the expansion interface port. The top-left contact is the no. 1 contact, and the top-right contact is the no. 2 contact. The contacts in the left column are consecutively odd as you go down the column; nos. 3 through 17 odd are the parallel data lines, with pin 3 being the PA0 line (the least significant digit), and pin 17 being PA7 (the most significant digit). Correspondingly on the PET, pin C is the LSD and PIN L is the MSD.

On the PET, the bottom contacts are used. The PET connector is a 12-position, 24-contact connector with 0.156-inch centers between contacts. The connector vendors are mentioned in the PET manuals. The Quik Printer II connector is a 17-position, 34-contact connector with a 0.1-inch spacing between contact centers. I used a manual wire-wrap tool to make these connections.

If you don't want to enter the program in machine language using the TIM monitor, I will send you a tape of it for $5. To produce the tape I used a monitor program (see "PET Mini Monitor" by William H. Perdue, Oct. 1980, *Microcomputing*, p. 88) located at 133A (4922) to copy the machine-language program to tape.■

```
.:  0338 20 20 A9 FF
 8D 43 E8 A0
.:  0340 00 AD 4C E8
 09 E0 8D 4C
.:  0348 E8 20 B1 03
 A2 00 B9 00
.:  0350 80 20 7C 03
 20 D0 03 C8
.:  0358 98 C9 00 D0
 07 20 91 03
.:  0360 C9 84 F0 0C
 E8 8A C9 14
.:  0368 D0 E4 20 B1
 03 4C 4C 02
.:  0370 A9 00 8D 50
 03 8D 83 03
.:  0378 8D 90 03 60
 C9 20 10 07
.:  0380 EA B9 00 80
 18 69 40 8D
.:  0388 4F E8 60 00
 8D 18 69 40
.:  0390 80 AD 50 03
 18 69 01 8D
.:  0398 83 03 8D 50
 03 60 EA EA
.:  03A0 AD 49 E8 E9
 E0 8D 90 03
.:  03A8 AD 49 E8 ED
 90 03 30 F8
.:  03B0 60 A9 0D 8D
 4F E8 20 D0
.:  03B8 03 AD 02 02
 69 20 8D 90
.:  03C0 03 AD 02 02
 ED 90 03 30
.:  03C8 F8 60 A0 03
 20 A0 03 60
.:  03D0 AD 4C E8 29
 AF 8D 4C E8
.:  03D8 20 A0 03 09
 E0 8D 4C E8
.:  03E0 20 A0 03 60
 7E A0 F3 84
```

Listing 2. Hex dump of the Print Screen program.

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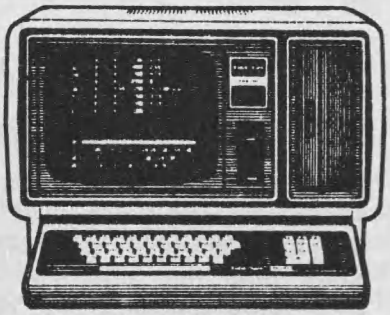

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This Apple word processor, with its "window concept," shows how your page will be printed.

What You See Is What You Get

By David C. Goodfellow

I bought my Apple II in August of 1978, mainly for word processing. Unfortunately, at that time Apple II word processing was just a dream.

But if ever a dream has come true, word processing is it. Today you can pick from many systems for the Apple, and seldom go far wrong. They all try to make a typewriter of the Apple, and they all claim to be the best on the market—and the beauty of it is that most of them seem to have one or two features that back up that claim.

This a happy problem for the buyer; happy because he now has a choice, and a problem because there are so many good word processors to pick from. The difficulty is not in finding a system that works, so much as finding one that fits your work habits and the kinds of typing jobs you wish to do.

It's important to pick the right program for two reasons. First, few of us can afford to buy one word processing program after another at $50 to $250 a clatter. Second, becoming proficient in the use of any word processor, no matter how basic, requires much time. If you can pick software that's right for you, and stick with it for all your word processing needs, you're far better off than if you have several systems and are master of none.

Magic Window, by Artsci (10432 Burbank Blvd., North Hollywood, CA 91601, 213-985-2922), is a good, serviceable system with several features that make it exceptional. One of these is that it makes your Apple act more like a typewriter than do most other word processing systems. Designed with a "what you see is what you get" concept, Magic Window puts a simulated sheet of paper on the screen. When you type, the words appear on the screen in the location they will occupy on the paper. With one or two minor exceptions, formatting commands are done elsewhere, so they do not clutter up the screen.

Another feature that I especially like is the fact that you can save your files in either of two ways—formatted (binary) or unformatted (text). You can save the same file both ways, as long as you use a different file name.

Binary files are great. They take less disk space than text files, and are saved and loaded faster. In most cases I would prefer to save my text in a binary file.

But text files do have their uses. One of these is data communication. If you want to squirt a letter or a program to a friend with another computer (whatever its brand name), you can send a text file over the telephone. That's one of the few ways different brands of computers can talk to each other.

Also, a word processor which can use text files can be used to debug—or create—other software. Write a program with Magic Window, and save it as a text file. Execute that file and your program's ready to run. If it needs debugging, suck it back into Magic Window and use its editing tools.

Details

The program is fully menu-driven. Menu selections take you in for specific functions, and menu selections bring you out. The master menu, called Subsystem Menu, gives you six choices—Editor Subsystem, Format Subsystem, Filer Subsystem, Printer Subsystem, Configuration Subsystem and Exit to Basic.

- Editor Subsystem. Selecting the editor from the subsystem menu gives you a simulated page on the screen, on which to type. Here you type whatever text you wish, backspacing to correct typographical errors that you may spot as you go along. The program gives you a window to the page, so you can pretty much see what the page will look like. Since the Apple II screen is only 40 characters wide, this window does not show the whole page—but what you do see is a good representation. You back out of the editor function through a control sequence SHIFT-CTRL-P—the three keys held down at once. This returns you to the subsystem menu.

Editing functions include—

Cursor motion group (left, right, up, down, up half-window, down half-window, top of file, end of file, set tab stop, clear tab stop, clear all tab stops, tab left, tab right, assign search string, search for assigned string and cursor to page sequence)—This last item allows you to find the top of any selected page in your document.

Character editing group (delete, insert, copy and control characters)—The control characters command allows you to enter a control character in text to implement a special printer function you may have.

Line editing group (deleted line stack, delete, recover, moving lines, insert, clear, split, glue, justification)—Justification includes center line, left justify line, right justify line, expand line (left/right justify) and pack line. Justification is done on-screen, a line at a time, and with use of the REPT key is quite fast. Split-and-glue is the program's equivalent of the cut-and-paste operation many typists go through to avoid retyping the doc-

Address correspondence to David C. Goodfellow, PO Box 66834, Seattle, WA 98166.

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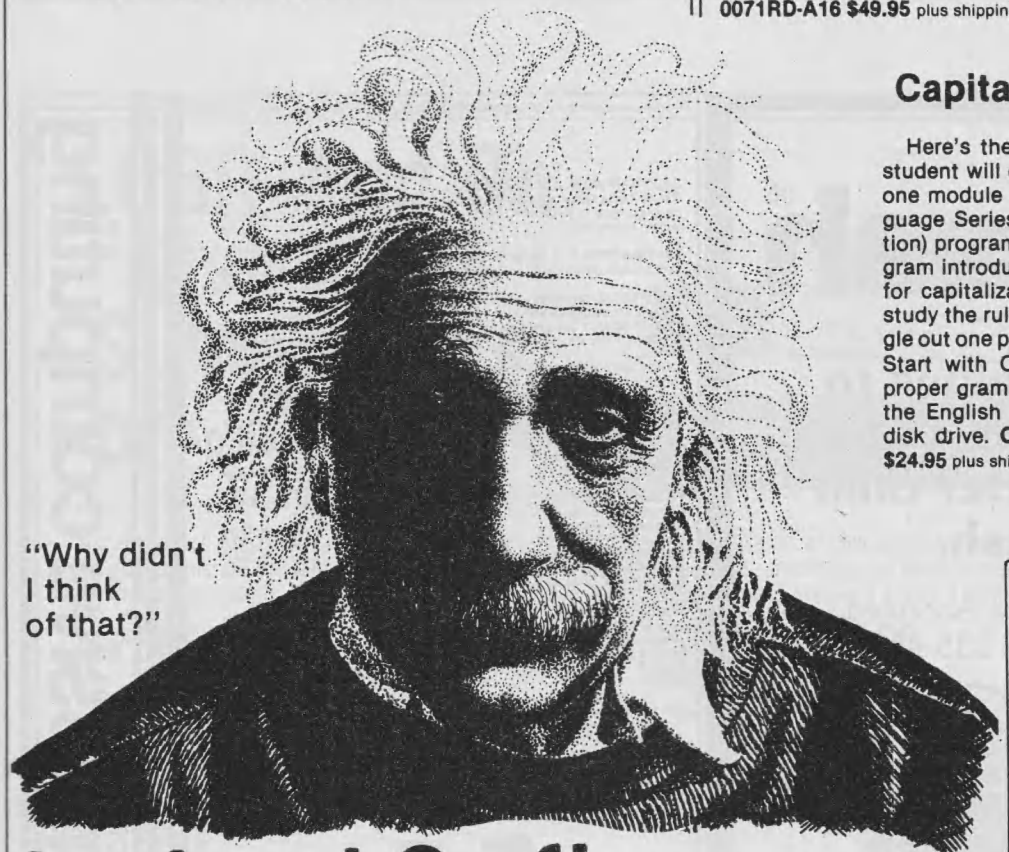

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ument. The line is split at the chosen point, and new text is added at the split.

Other functions (assign title line, and exchange key sets)—Assign title line allows you to put a title and page number in what is normally the white space of the top or bottom margin. Exchange key sets makes available the backslash, left-and-right brackets and left-and-right curly brackets on the display—characters not normally available on the Apple keyboard.

- Format Subsystem. Format allows you to specify page length, left margin, text width and whether or not you wish double-spacing.
- Filer Subsystem. Filer choices are change disk options, files directory, save formatted file, load formatted file, unformatted load/save, delete file and clear file in memory. Each function is supported by its own directions, appearing on the screen when that function is selected.

Points of interest in the Filer Subsystem are change disk options and unformatted load/save. Disk options that may be changed are disk slot and drive number, and the volume number of the disk to be used. Unformatted load/save gives you the choice of change range option, save file, load file and insert file at cursor. These are powerful features, which you can use to piece together a document from paragraphs in a text file. Suppose you have document A in memory, and you wish to add paragraphs from document B, which is in a text file. With "change range option" you select the desired part of document B, and with "insert file at cursor" you place it where you want it in document A.

- Printer Subsystem. Printer allows you to change print options, print hard copy or print soft copy. Printer options include yes/no answers to "print lowercase" (yes means caps and lower), "print all pages," "stop at page end" (sheet feed) and "mark perforation." Also, you may decide what page number to start at. The option to mark perforation is a valuable feature for special-paper printers such as those which print on heat-sensitive paper. The paper for these comes in rolls, with no means to show page end. This option puts a series of dashes across the paper to indicate where to cut it for page division.

"Print softcopy" saves the file to disk as a text file. You can do the same thing with an unformatted save from the filer subsystem—except that "print softcopy" gives you a text file that must be printed from another program (sample listing supplied).

There is a reason for this. With the simple print program and a text file saved with soft copy, an untrained operator can handle the printout while you go on to bigger and better things. And, that printout can be interrupted for personalized inputs from the keyboard or a data file.

- Configuration Subsystem. This function allows you to change the configuration options, update configuration boot file, boot the configuration file or load the RAM printer driver. These are all well-explained in the manual, and pertain to matching your printer with the program.

Strong Points

I like the window concept, because

with it I can get a better idea of how the page will look when printed. This concept will be especially useful when the program is made to support an 80-column board—in about December, according to Bill Smith of Artsci.

I also like the choice of binary or text files, as discussed earlier.

The ability to assign a title line within the top or bottom margin (outside the space regularly available for text) is a real convenience.

As a special order option, Artsci supports the special features of a number of printers—Diablo and Epson among them. The Diablo package includes incremental spacing, which I consider to be important. It makes the program that much more capable of competing with the expensive systems used by many large companies.

A deleted line is not necessarily lost forever. Instead, it is placed on a stack of such lines, and may be replaced in its original position or moved to another location. As many as 16 lines may be moved at one time in this fashion.

The manual is excellent, with one exception (discussed below). All the necessary information is there, at a level even I can understand. Also included is a color crib sheet to be posted nearby for reference. This sheet is a drawing of the Apple keyboard, with each key's control function defined. The drawing is also reproduced in the manual itself, in black and white.

Weak Points

The pack line function deletes all extra spaces between words. This is a good function for making room to insert a forgotten character and so on, but it is not selective. Typing rules call for two spaces after a period ending a sentence. Pack line deletes the second space, and it is often quite difficult to replace it. The problem is compounded when a line is expanded after packing, for the result is often one space after the period and two spaces somewhere else.

Although the program has a good search string function, it could do with a find-and-replace, in which a selected phrase or word is automatically replaced by another. I imagine this would be difficult to do with a program such as this which specifies line length before typing is started.

The structure of the program does not allow changing the line length of an existing document, unless you go through the hassle of split-and-glue before printing with the new line lengths. My particular application sometimes demands this, to print out the same document with a different type size and format. But my application is probably not typical.

Although the manual is excellent, I think one more section is in order for a program of this complexity. That is an exercises chapter which takes you through the system—inputting text, exercising all the editing functions, saving to disk in all the ways possible and outputting to the printer. The manual as it stands is a reference book—it needs to lead the user through some hands-on experience.

The manual also should tell the reader what options are available for the system—such as printer routines for specific printers. These routines are available, and they make the system that much more valuable. The

See List of Advertisers on page 210

CORRECTIONS

The correct title of the article by Michael Brandt and Michael Brodner in the October 1981 issue of *Kilobaud Microcomputing* (p. 80) is "Distributed Intelligence Networks in the Office Environment."

The program listing of "An Incredible High-Speed Journey to the Stars" as published in the September 1981 *Kilobaud Microcomputing* (p. 172) is incomplete. The following lines should be added to the end of the program:

```
1710 REM ROUTINE TO READ DATE.
1720 INPUT "Type date here: ",M8,D8,Y8
1730 IF M8>12 THEN 1770
1740 IF D8>31 THEN 1770
1750 IF Y8<1800 THEN 1770
1760 RETURN
1770 PRINT "Invalid format. Date must be of the
form 8,21,1940"
1780 GOTO 1720
1790 DATA "SiriusCanopusAlpha CentauriVega-
RigelProcyonBetelgeuseAltair"
1800 DATA "SpicaAntares"
1810 DATA 2,7,90,1,3,8,0,250,3,5,200,5,1,70,120
1820 DATA 1,6,7,13,14,27,28,31,32,36,37,43,44,
53,54,59,60,64,65,71
```

way it's handled now, follow-up letters are sent to those buyers who send in the registration cards included with the package.

Conclusion

The more features available on a word processing program, the more complex is its operation. Magic Window is no exception. Making full use of the program's capabilities requires practice. Although you'll be able to do simple jobs with Magic Window almost immediately, it will take some time to become an expert with all its capabilities.

The system requires an Apple II or Apple II Plus with at least 32K RAM and a disk drive. It is more effective with 48K RAM and a second drive, and it will support a lowercase adapter (such as Paymar's) and the Apple Language System, which gives it 10K more text storage.

Magic Window represents an easy transition from typewriter to computer. The program was designed with the typist in mind, and a newcomer to word processing is not likely to be intimidated by it. At $100 retail, it's a good buy.■

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↙See List of Advertisers on page 210

Don't put off those interface projects any longer. Construct a parallel port board for the C1P and open up a whole new world of applications.

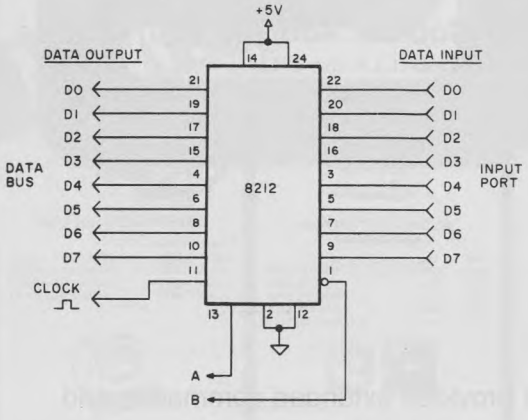
Arm the OSI With Parallel Ports

By Roy Griffin

In the months before I bought my Ohio Scientific Challenger 1P, I had collected several hardware projects that I planned to build and use with it. All these projects had one thing in common: they all interfaced through one or more parallel I/O ports, which the single-board C1P doesn't have.

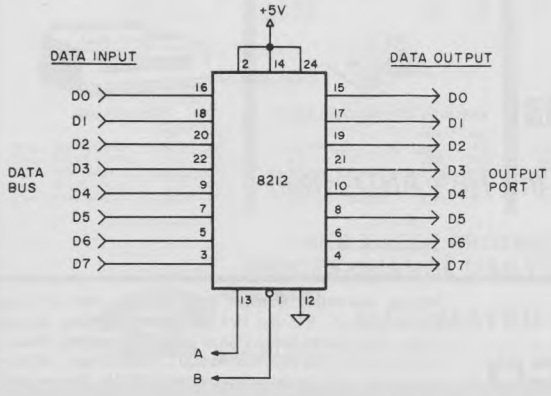
I could have bought OSI's parallel port board, but I would also have had to buy their expansion (610) board. Since I had already spent all I could afford, I decided to design my own board. For the C1P or Superboard II, it can turn your computer into an important tool for control applications in the real world.

If you don't have a C1P or Superboard II, read on; with an understanding of the concepts involved and with some modifications, this board could be used with virtually any eight-bit microcomputer.



A	B	CLK	DATA OUT EQUALS
0	0	X	TRI-STATE
0	1	X	TRI-STATE
1	0	0	LATCHED
1	0	1	DATA IN
1	1	X	TRI-STATE

Fig. 1. The 8212 IC as an input port.



A	B	DATA OUT EQUALS
0	0	LATCHED
0	1	LATCHED
1	0	DATA IN
1	1	LATCHED

Fig. 2. 8212 output port.

The Intel 8212

The heart of the parallel port board is the Intel 8212 I/O port IC. I chose this chip for several reasons: it is inexpensive and easy to get (you can mail order it from almost any electronics or computer parts supplier for about $3.50), and it's versatile. The chip can be configured as an input port or as an output port, and it has tri-state capabilities.

Fig. 1 shows the 8212 configured as an input port. With either pin 1 high (+5 V) or pin 13 low (0 V), the output of the 8212, which is connected to the data bus, is in the tri-state or high-impedance mode. This is equivalent, as far as the data bus is concerned, to having the 8212 and the data bus completely disconnected from each other.

When pin 1 is pulled low (grounded) and pin 13 is pulled high (+5 V) at the same time, the output of the 8212 becomes active: a positive-going clock pulse at pin 11 transfers data from the input port lines to the data bus. When the clock pulse goes low the 8212 latches, completing the data transfer. After the transfer has taken place, returning pin 1 high or pin 13 low causes the 8212 to again enter the high-impedance state.

Address correspondence to Roy Griffin, 2906 B East Glen, El Paso, TX 79936.

Fig. 2 shows the 8212 configured as a latching output port. To transfer the contents of the data bus to the output port, you pull pin 1 low and pin 13 high. Returning either pin 1 to (+5 V) or pin 13 to ground will cause the output of the 8212 to latch.

Designing around the Challenger

The Challenger 1P and Superboard II are based on the 6502 processor. This fact is notable in that the 6502 processor does not have separate control signal outputs for I/O operations and for read/write (memory) operations. This means that the CPU does not know the difference between an I/O port and a memory location. You cannot therefore assign both an I/O port and memory to the same address. Some other processors, such as the 8080 or Z-80, have provisions for just such an overlap of memory and I/O ports.

Since the 6502 processor does not distinguish between memory and I/O ports, you must be careful to choose as a location for the I/O ports an address that will not conflict with any memory in the C1P or with any memory you might want to add later on.

By consulting a memory map in the user's manual, I decided on decimal locations 63232 through 63235. In analyzing the Superboard II schematics, I noticed that the designers of the C1P skimped a bit on their address decoding: they assigned more than one address to some of their memory and serial port locations. While this is not good design practice from the standpoint of expandability and efficient use of memory space, it does save on parts count and makes things less expensive. I opted for the same approach and only decoded ten address lines in my design.

Fig. 3 shows the address decoding circuitry for the parallel port board, along with the bidirectional bus transceivers (8T28s), an input port and an output port, and some control circuitry to make things happen at the right times.

The output lines of the 74LS155 decoder control which I/O port is to be accessed by pulling pin 1 of the appropriate port low. The buffered read/write line is connected to pin 13 of each of the input ports to enable the input ports only on a memory read cycle. The inverted read/write line connects to pin 13 of each output port to assure that the output ports are enabled only on a memory write.

The 8T28 ICs of Fig. 3 are not really necessary for the C1P because there are bus transceiver sockets on the board already. However, I have included these ICs on the parallel port board so it can be used with other computers without loading down the data lines. Included in Fig. 3 is some logic circuitry to change the data direction of the 8T28 bus transceivers at the appropriate time.

Fig. 4 shows the remaining two input and output ports. They occupy locations 63234 and 63235 (decimal). The two 74LS365 ICs form an input status port and an output status port.

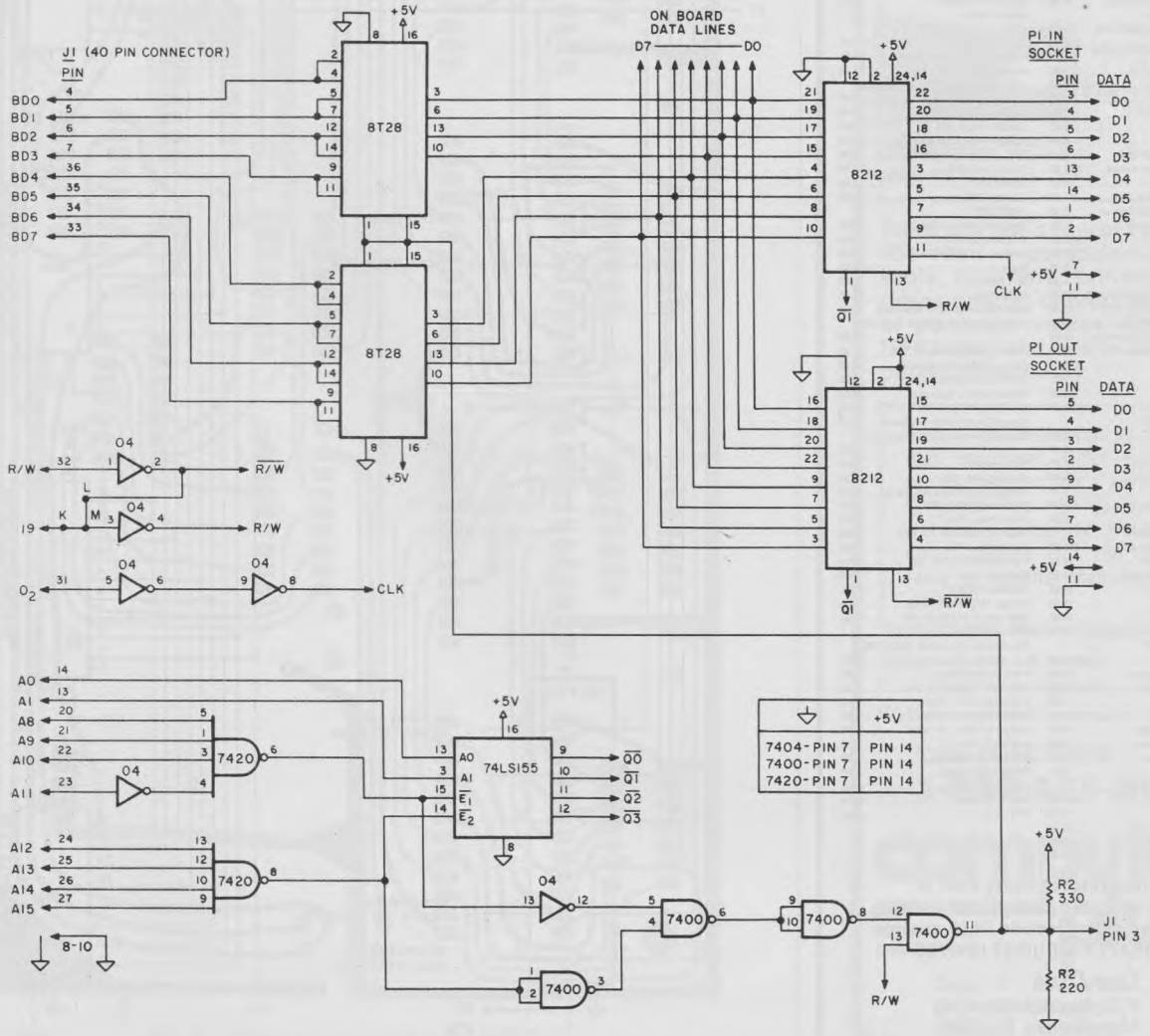


Fig. 3. Port 1 and decoding logic schematic.

They can be used to provide necessary handshaking signals such as data ready and data received acknowledge, which ensure that the data transfer between the port and peripheral is done successfully. I think it will become clear how these lines are used when you hook up your first peripheral to the port board. Note that these handshaking signals are provided to or obtained from the peripheral through software.

The 74LS365 ICs are unidirectional buffers. These buffers have two enable pins and tri-state outputs. They work like the 8212 output ports except that in the 74LS365s, the outputs do not latch. They remain in a tri-state condition unless a data transfer is taking place. The status ports occupy location 63232 and are generally accessed before a data transfer to see if both computer and peripheral are ready to make a data transfer, and after a data transfer to see if the transfer was successful.

Construction

The component side of the parallel port board is shown in Fig. 5, and the bottom side in Fig. 6. Fig. 7 shows the component placement on the component side of the board. Before you start madly soldering components to the board, be sure to use the board as a template and mark the mounting hole locations on the top of the C1P case. This will make mounting the

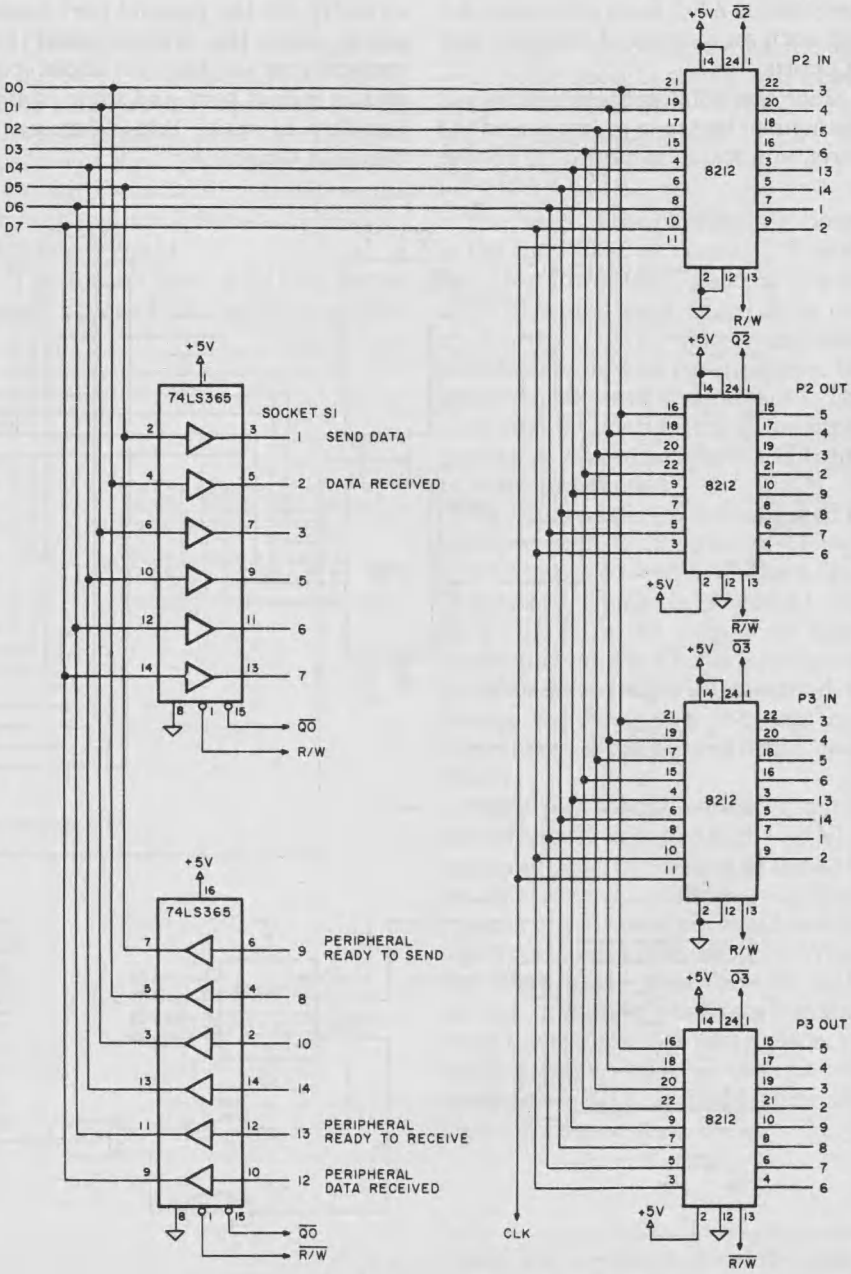


Fig. 4. Ports 2, 3 and status port schematic.

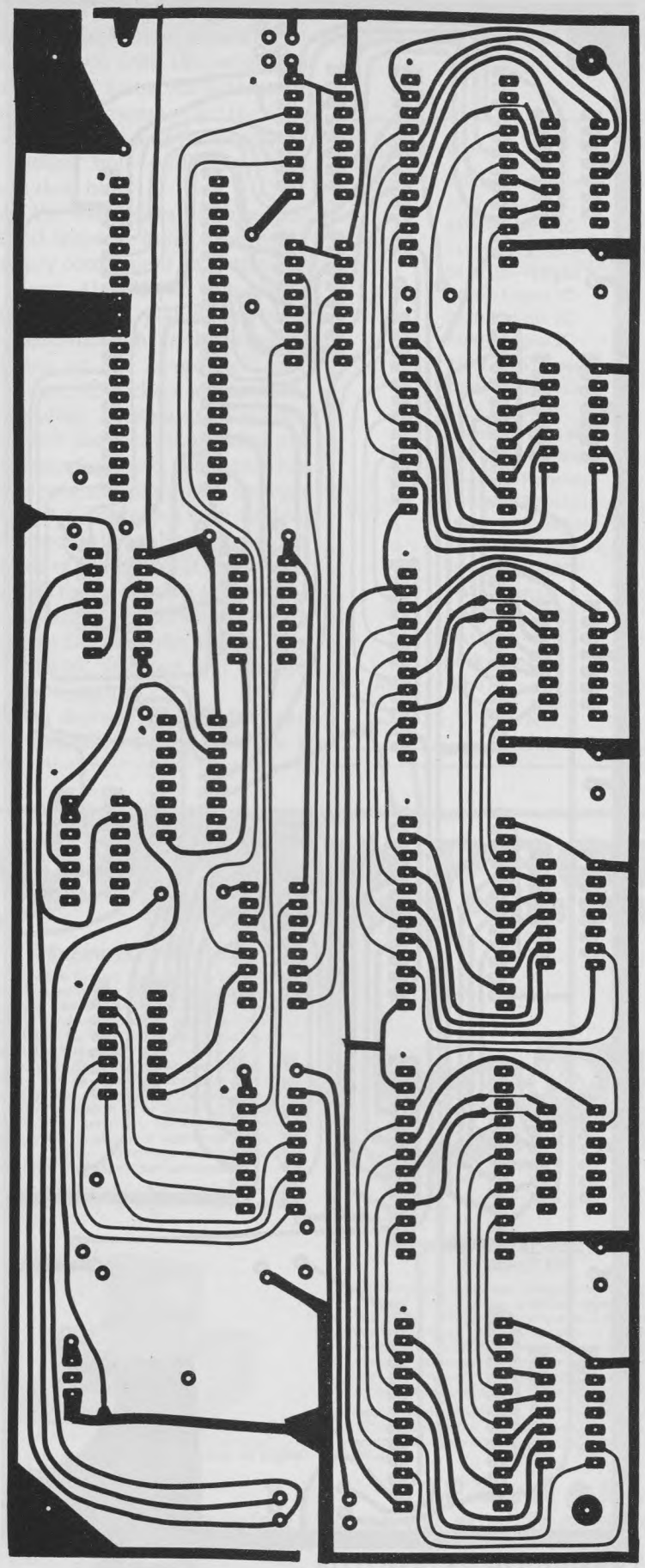


Fig. 5. Component side of parallel port board.

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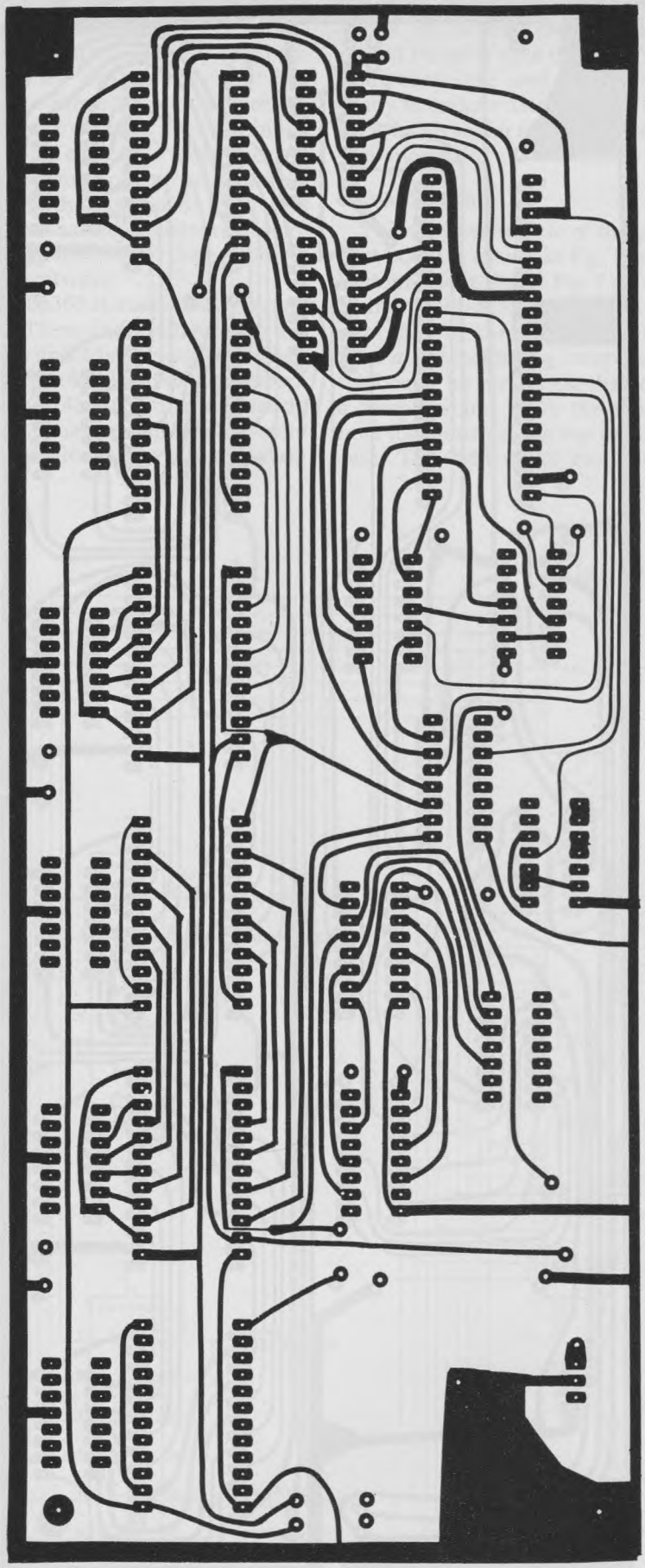

Fig. 6. Bottom side of parallel port board.

board much easier.

All the holes on the board may be drilled with a 60 drill bit (available at any hobby shop) with the exception of the mounting holes. All holes used for mounting purposes—i.e., the four board mount holes and the regulator (7805) mount hole—will require a 3/16-inch drill bit.

If your PC board does not incorporate plated through holes, you must solder every component on both sides of the board. Also, if you don't fully populate the board, you will need to provide feed-throughs in the unpopulated holes or the board will not work. Where IC sockets are needed, use wire-wrap sockets, and solder them in with the sockets standing off from the board at least .2 inches. This .2 inch clearance gives you enough room to get a soldering iron underneath the socket to solder the leads on the top side of the board. It is also better to install the necessary sockets before mounting any other components on the board. Once the socket has been mounted, you can clip off the excess lead length.

Note that there is a small dot near each IC location to indicate the pin 1 alignment for that IC. A dot is also shown in Fig. 7 to indicate which pin is pin 1. Note also that all ICs face in

Qty.	Items
1	Printed circuit board
6	8212—24-pin IC
2	8T28—16-pin IC
2	74LS365 or 367—16-pin IC
1	74LS155—16-pin IC
1	7404—14-pin IC
1	7420—14-pin IC
1	7400—14-pin IC
1	330Ω 1/4 W resistor
1	220Ω 1/4 W resistor
1	7805 regulator
1	Regulator heat sink
1	330 uF/10 V capacitor
1	40-pin DIP socket
6	14-pin DIP socket
1	16-pin DIP socket
3	.01 uF/50 V disc. cap.
1	40-pin DIP cable
4	1/4" spacers
4	1/2" screw 6/32
4	Nut 6/32
4	Lockwasher
Misc.	Wire

Parts list.

↙See List of Advertisers on page 210

the same direction with respect to pin 1 on Fig. 7. You will notice on Fig. 7 some jumpers labeled A through M. These jumpers should be made of insulated wire to prevent shorting out traces on the board.

Once all the components have been mounted on the board, some dc power source of between 6 and 8 V must be connected between the input of the 5 V regulator (7508) and ground. I used the rectified output of the power supply provided in my C1P. This is all right as long as the power supply has the ability to provide the extra current needed to run the parallel port board. If the power supply is inadequate you will most likely either blow a fuse or have trouble getting your computer to operate properly. A heat sink on the 7805 regulator is necessary to keep the 7805 from overheating.

After the board has been assembled, drill 3/16-inch holes in the top of the C1P case, open it up and mount the board with the I/O port sockets facing toward the back of the computer. You will need to remove the six screws that hold the keyboard in place. The port board will mount between the computer board and the top of the case. It will probably be easier to test the port board with the C1P in this disassembled condition. Watch what you touch, though. There are some dangerous voltages near the on/off switch.

After mounting the board on the inside of the C1P case on 1/4-inch spacers, plug in a 40-pin DIP jumper cable (you'll need about 12 inches) between the C1P expansion socket (J1) and the 40-pin socket on the I/O port board. Make sure that the pin 1 cable mark-

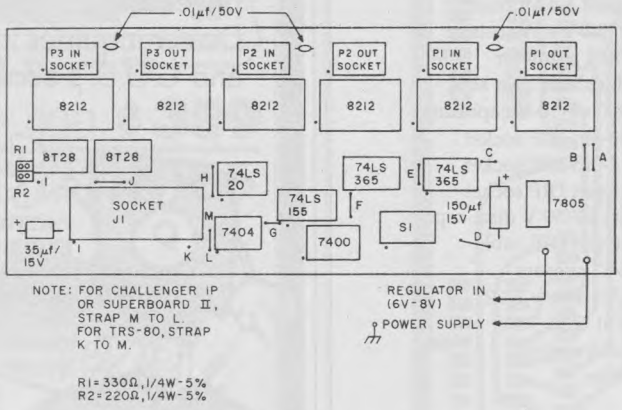

Fig. 7. Component placement.

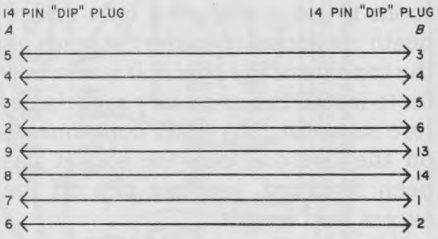

Fig. 8. Test cable wiring diagram.

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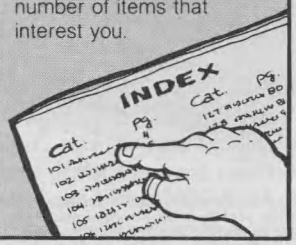

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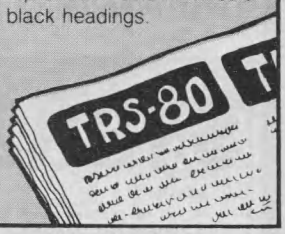

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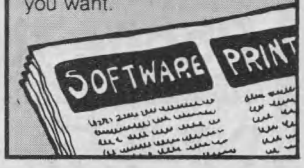

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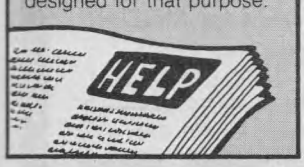

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ers correspond to pin 1 on each of the two sockets; otherwise, you may damage your C1P.

There is one other thing I think I should mention. My Challenger came without the 8T28s plugged into the U6 and U7 sockets on the computer board. You will need these ICs or the parallel port board won't work.

Testing

Fig. 8 shows a wiring diagram of a cable that can be used to verify that the port board is functioning properly. Once the cable has been made, label it as per the figure (*this is important*). Then connect the A side of the cable to the P1 out socket, noting the pin 1 alignment. Connect the B side of the cable to the P1 in socket, also noting the pin 1 alignment.

Type in the test program and run it. The program will output to output port 1, which will in turn input to input port 1 for verification. If the test fails, the program will print which bits are not working. Ports 2 and 3 can be checked by moving the cable between the appropriate port sockets (i.e., P2 in–P2 out, P3 in–P3 out) and running the program.

Using the Board

To transfer data to an output port, simply use the basic POKE command just as you would if you were transferring data to a memory location. For instance, the command "POKE 63233,200" would transfer the binary equivalent of the decimal number 200 to output port 1, "POKE 63234,100" would transfer the binary equivalent of the decimal number 100 to output port 2, and so on.

Similarly, to transfer data from an input port to the data bus, use the PEEK command just as you would use the PEEK command to get data from a memory location.

To implement a working I/O transfer situation, you may want to (or need to) use the input and output status ports to provide handshaking signals between the computer and the peripheral. The status port pins of Fig. 4 have been assigned control functions, although these assignments are arbitrary and could be changed at will.

Fig. 9 shows a flowchart of a typical input and output data transfer. The parallel ports you now have available to your microcomputer can open up a whole new world of applications. With its 24 input lines, 24 output lines and 12 status lines, your computer can begin to control and monitor the outside world.■

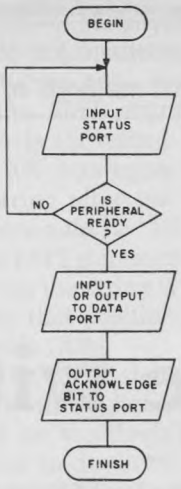

Fig. 9. I/O transfer flowchart.

```
100 PRINT "WHICH PORT DO YOU WANT TO TEST—1, 2, 3"
110 INPUT X: IF X≠1 AND X≠2 AND X≠3 THEN 100
120 Y=63232+X
130 X=0
140 GOSUB 400
150 Z=1
160 GOSUB 400
170 Z=2
180 GOSUB 400
190 Z=4
200 GOSUB 400
210 Z=8
220 GOSUB 400
230 Z=16
240 GOSUB 400
250 Z=32
260 GOSUB 400
270 Z=64
280 GOSUB 400
290 PRINT: PRINT: PRINT: PRINT "TEST COMPLETE"
300 GO TO 100
400 POKE Y, Z
410 A=PEEK (Y)
420 IF A≠Z THEN GOSUB 500
430 RETURN
500 PRINT "PORT" X "FAILS"
510 PRINT "INPUT= "Z "OUTPUT= "A
520 RETURN
```

Test program.

See List of Advertisers on page 210

For those big boppers who tape music (or other material) from records, this Micropolis program offers several methods of balancing the timing of the tape.

Keep in Tune with the Times

By Joel Shapiro

Like many music buffs, I like to transfer my prized records to tape before they show signs of wear.

The main problem isn't transferring the music, but doing so with a minimum amount of dead time on either end of the tape. The manual calculations required are usually more than I care to do, forcing me to accept a less professional recording than I want.

This program, written in Micropolis BASIC (version 4.0), is designed to make tape recording easier. It requires only a single-drive system, and, although I have a 48K memory, program capacity and size can be reduced for systems with less. You also need an 80-column printer.

Some of the program's features are as follows:

It uses a disk file for record data. All record data for both singles and albums is entered into a disk file, so you can get different mixes.

All record and tape times are entered in minutes and seconds. All time conversions are done within the program. Operator prompting and console messages are also in the same format.

It has adjustable timing within the program. The number of selections that can be entered can exceed the time available on the tape. Selections can then be deleted from the selection array and will not be considered in the time calculations. This in no way affects the data on disk, as that remains unchanged.

It can space between selections. You can add up to ten seconds of space between each selection, which is considered in the calculations.

It has three different methods of balancing. This should suit both the type of music being recorded and your personal preferences.

It prints a list of selections in balanced format. The printed listing shows how each selection should be placed on the tape for balance within the criteria selected by the user. This will also double as a catalog sheet for use in a library function.

It sorts output. Whenever possible, the output report will show selections in album order for ease in recording.

Although written in Micropolis BASIC, many of the statements have similar functions provided by other BASICs, so conversion to yours should present few problems.

The Program

The program is over 11K in length. This can be reduced by eliminating the REMARK (shown as ! in the listing) statements. You can further reduce the program size by decreasing the amount of text used in the prompts and error messages.

The arrays accommodate up to 60 selections; if available RAM becomes a problem, this can be reduced. Note that variable B% is set to 60 in line 110 of the program and is used for both a loop terminator and for the timing calculations. If you do decide to reduce the capacity, be sure you don't affect the calculations in lines 180 and 190.

Note the statements in lines 400 through 520. These provide the CLEAR SCREEN and VERTICAL CENTERING for my system and should be changed to accommodate yours. The USER DEFINED FUNCTION (FNA) in line 50 serves to center a line of text horizontally on the screen.

The STRING statement in the same line changes the string delimiter to ASC(255). The normal string delimiter in most BASICs is a comma, and if that is the case with yours, you'll have to be careful not to use a comma in any of the text entered into the program while in operation.

Micropolis BASIC uses fixed-length strings, and these must be defined in arrays. Note in line 100 that all string arrays dimensioned show two numbers within the parentheses. The first number is the number of elements in the array. The second is the maximum length of the string allowed in the array.

The subroutine in lines 200 through 220 requests a file name, searches for the file on both drives and opens it if found. If it can't be located, you will be asked if you wish to create one. Once the file is created, operation continues normally.

The subroutine in line 240 prints a line of periods matching the length of the text being requested, and serves to show the user how much text will be accepted in the string.

All program functions are selected from the main menu in lines 1500–1540, and all program functions will return to this menu upon completion.

Adding Data to File

This function, which begins in line

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1550, lets you add data to an existing or newly-created file. The first entry required determines whether an album or single selection is being entered. If an album is entered you'll be asked to enter a series of selections for each side. If it is a single, you'll be allowed only one selection per side.

Album titles are recorded on the disk, as are the selections. However, each is recorded in a different format so the system recognizes each of them. The coding is done in variable J$, which can be broken down into five characters. The first two characters denote the album number, the next denotes the side and the last two denote the band or selection number.

An album title will show only the album number and 000. A single will show 00, A or B for the side and 01 for the selection. An album selection will show album number, side and selection number. Note that album numbers and selection numbers are determined by the system and are not entered by the user.

This may be a good time to explain the FMT statement used in this BASIC. The statement is similar to a PRINT USING statement but can also be used in formatting data for use in the program or in the files. Referring to the FMT statement in line 1640, R% is formatted to the string "99." If R% was equal to 5, the resultant string after use of the FMT statement would be "05." This is because the FMT statement will replace each "9" in the string with a 0 unless a digit for that position is present in the variable (R%).

Since the FMT statement is used frequently throughout the program, it would be worthwhile to write a subroutine to duplicate the function if your BASIC doesn't have its equivalent.

In the input sequence the backslash will be used to terminate entry for each side of each album and also to terminate the entry sequence. There is nothing sacred in using a backslash for these operations. I use it only because it's handy.

Note that the record time is entered in minutes, (space), seconds format. This BASIC will accept either a comma or a space between numerical entries. You may use a comma to delimit each number if yours requires you to do so.

After termination of the data entry sequence, a final record will be written into the file and the file closed. The final record is used to retain the album number of the last album entered so the number won't be duplicated if you make additional entries.

Performing Calculations

With this function, the file will be accessed and read into memory; the console will show how many entries are in the file and their timing. Note that the timing shown per side is just the total time divided by two and is to be used only as a guide in planning your recording.

It is in lines 1770–1790 that the file is read, album titles are separated from selections and both types of data are stored in their proper arrays. Line 1810 requests that you add up to ten seconds of allowance between selections, and line 1820 adds that into the timing array.

Program Listing. Tape recording program in Micropolis BASIC.

```
 10 !                TAPEREC
 20 !   RECORD TO TAPE RECORDING CALCULATOR
 30 !   BY JOEL SHAPIRO - BONJOEL ENTERPRISES
 35 !   (C) 1981 BONJOEL ENTERPRISES
 40 !
 50 DEFFNA(X$)=40-INT(LEN(X$)*.5):STRINGCHAR$(255):Y$=CHAR$(255)
100 DIMB$(20,5),D$(20,40),G$(20,40),J$(60,5),C$(60,40),R$(60,40),A$(100),M%(60),C%(60),N%(60),H%(60)
110 B$="\":Z$="9999":B%=60:T=20
120 GOTO1510
170 !   CALCULATE MINUTES AND SECONDS
180 M=M%\B%:S=MOD(M%,B%):RETURN
190 M=M%(I)\B%:S=MOD(M%(I),B%):RETURN
200 !   ACCESS FILE
202 IFN$<>""GOSUB410:PRINTTAB(T)"Same File: ";RIGHT$(N$,LEN(N$)-2);:GOSUB560:IFA$="Y"N$=RIGHT$(N$,LEN(N$)-2):GOTO206
203 GOSUB410:PRINTTAB(T)"Enter Name of File or \ to Exit Routine"
204 PRINT:PRINTTAB(T);:INPUTN$:IFN$=B$GOTO1510
206 FORN=0TO1:A$=MID$(STR$(N),2,1):OPEN1A$+":"+N$ERROR210
208 N$=A$+":"+N$:F=ATTR(1):RETURN
210 IFERR=40RERR=7NEXTN:IFERR=7PRINTTAB(T)"Drive 1 not up - correct and":PRINTTAB(T);:GOSUB550:GOTO206
211 IFERR=4GOTO214
212 PRINT:PRINTTAB(T)"DISK ERROR - ";ERR$;" - STOPPED":PRINTTAB(T)"Correct and ";:GOSUB550:GOTO202
214 GOSUB410:PRINTTAB(T)"File cannot be found on Disk":PRINTTAB(T)"Do you wish to create a new file";:GOSUB560:IFA$="N"N$="":GOTO
    1510
216 A=0:PRINT:PRINTTAB(T)"Enter DRIVE NUMBER for new file";:INPUTA:IFA<0ORA>1GOTO216
218 N$="":PRINT:PRINTTAB(T)"Enter NAME for new file";:INPUTN$:N$="N:"+FMT(A,"9:")+N$
220 OPEN1N$:N$=RIGHT$(N$,LEN(N$)-2):RETURN
240 PRINT"    ";REPEAT$(CHAR$(46),X%);CHAR$(13);:PRINTREPEAT$(CHAR$(32),T);:RETURN
299 !   WRITE RECORD TO FILE
300 PUT1RECPUT(1);M$Y$+J$+Y$+C$+Y$+R$+Y$:RETURN
310 !   WRITE FINAL RECORD TO FILE
320 X$="":PUT1RECPUT(1);RX;Y$+X$+Y$+X$+Y$+X$+Y$:ATTRS(1)=F:CLOSE1:RETURN
400 !   CLEAR SCREEN
410 PRINTCHAR$(26)
420 !   SPACE DOWN 11 LINES
430 PRINTREPEAT$(CHAR$(13)+CHAR$(10),11):RETURN
510 !   CLEAR SCREEN - NO SPACE DOWN
520 PRINTCHAR$(26):RETURN
550 INPUT"Press RETURN When Ready ";A$:RETURN
560 INPUT" (Y or N)";A$:IFA$<>"Y"ANDA$<>"N"GOTO560
570 RETURN
600 !   CALCULATE MINUTES AND SECONDS FOR TOTAL TIME
610 GOSUB180:PRINTTAB(T)"Total Time =";M;"Minutes,";S;"Seconds":PRINT:M%(0)=M%*.5:I=0:GOSUB190:PRINTTAB(T)"or";M;"Minutes,";S;"Se
    conds per side of Tape":PRINT:RETURN
1500 !   MAIN ENTRY POINT
1510 GOSUB410:A$="TAPE RECORDING TIMING PROGRAM":PRINTTAB(FNA(A$))A$:PRINT:PRINTTAB(T)"Functions Available":PRINT
1520 PRINTTAB(T)" 1) Add Data To File":PRINTTAB(T)" 2) Calculate Timing/Print Report":PRINTTAB(T)" 3) Write-Protect Disk File":PRI
    NTTAB(T)" 4) Delete File From Disk":PRINTTAB(T)" 5) Terminate Program"
1530 A%=0:PRINTTAB(T)"Select Function You Desire";:INPUTA%:IFA%<1ORA%>5GOTO1510
1540 ONAXGOTO1560,1760,3340,3370,3520
1550 !   ADD DATA TO FILE
1560 GOSUB202:IFSIZE(1)>1GET1RECORDRECPUT(1)-1X,RX,X$,X$,X$,X$:PUTSEEK(1)=RECPUT(1)-1
1570 X%=40:J%=0:S$="A":GOSUB410:PRINTTAB(T)"Enter (A) Album, (S) Single or \ to End Data Entry";:A$="":INPUTA$:IFA$<>"A"ANDA$<>"S"
    ANDA$<>B$GOTO1570
1580 IFA$=B$GOSUB320:GOTO1510
1590 IFA$="S"GOTO1680
1600 JX=1:GOSUB410:RX=RX+1:PRINTTAB(T)"Album Number";RX:PRINT
1610 A$="":PRINTTAB(T)"Enter Album TITLE":PRINT:PRINTTAB(T);:GOSUB240:INPUTA$:IFA$=""GOTO1630
1620 C$=A$
```

More

Program listing continued.

```
1630 A$="":PRINT:PRINTTAB(T)"Enter Album ARTIST":PRINT:PRINTTAB(T);:GOSUB240:INPUTA$:IFA$=""GOTO1660
1640 R$=A$:M=0:J$=FMT(RZ,"99")+"000":GOSUB300:GOTO1680
1650 !   ENTRY POINT FOR START OF SIDE
1660 IFS$="B"GOTO1570
1670 IFS$="A"S$="B"
1680 GOSUB410:B=0:PRINTTAB(T)"Beginning of entry for side ";S$:PRINTTAB(T)"Enter \ FOR TITLE when done with side":PRINT
1690 PRINTTAB(T)"Enter TITLE":PRINT:PRINTTAB(T);:GOSUB240:INPUTC$:IFC$=B$GOTO1660
1700 A$="":PRINT:PRINT"Last Artist Entered is ";R$:PRINT:PRINT"Enter only a RETURN to use this Artist or Enter New Artist":PRINT:P
     RINTTAB(T);:GOSUB240:INPUTA$:IFA$=""GOTO1720
1710 R$=A$
1720 M=0:N=0:PRINT:PRINTTAB(T)"Enter TIME for this band (Minutes (Space) Seconds";:INPUTM,N:M=M*BZ+N:IFM=0GOTO1690
1730 TZ=RZ:IFJZ=0TZ=JZ
1740 B=B+1:J$=FMT(TZ,"99")+S$+FMT(B,"99"):GOSUB300:GOSUB410:GOTO1690
1750 !   CALCULATE TIMING
1760 GOSUB202:GOSUB410:IFSIZE(1)<1PRINTTAB(T)"Nothing In File ";:GOSUB550:ATTRS(1)=F:CLOSE1:GOTO1760
1770 PRINTTAB(T)"Reading File Into Memory":SZ=1:MZ=0:K=0:FORI=1TOSIZE(1)-1:GET1CZ,M,J$,C$,R$:IFRIGHT$(J$,2)="00"K=K+1:B$(K)=J$:D$(
     K)=C$:G$(K)=R$:GOTO1790
1780 CZ(SZ)=CZ:MZ(SZ)=M:MZ=MZ+M:J$(SZ)=J$:C$(SZ)=C$:R$(SZ)=R$:SZ=SZ+1
1790 NEXTI:SZ=SZ-1
1800 GOSUB410:PRINTTAB(T)SZ;"Bands/Titles in File":PRINT:GOSUB610:PRINTTAB(T);:GOSUB550
1810 D=0:GOSUB410:PRINTTAB(T)"Enter Time (up to 10 seconds) to be added to each band":PRINTTAB(T)"for allowance between tracks of
     record":PRINTTAB(T);:INPUTD:IFD>10GOTO1810
1820 FORK=1TOSZ:MZ(K)=MZ(K)+D:MZ=MZ+D:NEXTK
1830 GOSUB410:PRINTTAB(T)"New Timing is";":PRINT:GOSUB610:PRINTTAB(T);:GOSUB550
1840 TZ=0:GOSUB410:PRINTTAB(T)"Enter Time For ONE SIDE of Tape (Minutes ONLY)";:INPUTTZ:TZ=TZ*BZ:IFTZ=0GOTO1840
1850 GOSUB410:IFTZ>=MZ(0)GOTO1890
1860 PRINTTAB(T)"Tape is too short for records. Do you wish to delete":PRINTTAB(T)"some titles";:GOSUB560:IFA$="Y"GOTO3170
1870 PRINT:PRINTTAB(T)"Do you wish to increase length of tape";:GOSUB560:IFA$="Y"GOTO1840
1880 GOTO1510
1890 PRINTTAB(T)"Do you wish to delete selections";:GOSUB560:IFA$="Y"GOTO3170
1900 !   CALCULATE RECORDINGS
1910 !   MENU FOR CALCULATION SELECTION
1920 GOSUB410:A$="TIMING BALANCE METHODS AVAILABLE":PRINTTAB(FNA(A$))A$:PRINT
1930 PRINT" 1) BALANCE PER INPUT/ALBUM SEQUENCE - Fill side 1 of tape,":PRINTTAB(4)"Balance on side 2 of tape.":PRINT
1940 PRINT" 2) BALANCE PER INPUT/ALBUM SEQUENCE - Side 1 longer but":PRINTTAB(4)"balanced to side 2 - May have some leftover tape
     if timing is shorter":PRINTTAB(4)"than tape length.":PRINT
1950 PRINT" 3) BALANCE REGARDLESS OF SEQUENCE - Closest balance possible.":PRINTTAB(4)"Side 1 longer, each side in album order if
     possible.":PRINT
1960 PRINTTAB(T)"Select Balance Method You Desire";:AZ=0:INPUTAZ:IFAZ<1ORAZ>3GOTO1920
1970 ONAZGOTO2040,2190,2400
1980 !
1990 !   C$(X), NZ(X) = CODE AND POINTERS FOR SIDE 1 OF TAPE
2000 !
2010 !   R$(X), HZ(X) = CODE AND POINTERS FOR SIDE 2 OF TAPE
2020 !
2030 !   BALANCE PER ALBUM SEQUENCE - FILL SIDE 1
2040 FZ=0:GZ=0:WZ=0:FORI=1TOSZ:IFWZ=0ANDFZ+MZ(I)<=TZFZ=FZ+MZ(I):NEXTI:WZ=SZ:GOTO2100
2050 !   SET WZ TO START ELEMENT FOR SIDE 2
2060 IFWZ=0WZ=I
2070 !   ACCUM SIDE 1 IN FZ, SIDE 2 IN GZ
2080 GZ=GZ+MZ(I):NEXTI
2090 !   CHECK TO SEE WE'RE STILL ON THE TAPE
2100 IFGZ>TZGOSUB410:DZ=MZ:MZ=GZ-TZ:GOSUB180:MZ=DZ:PRINTTAB(T)"OVER TAPE LENGTH BY";M;"MIN AND";S;"SEC":PRINT:PRINTTAB(T);:GOSUB55
     0:GOTO3180
2110 FORI=1TOBZ:C$(I)="":R$(I)="":NZ(I)=0:HZ(I)=0:NEXTI
2120 !   PLACE SIDE 1 DATA IN C$(X) ARRAY, SIDE 2 IN R$(X) ARRAY
2130 J=WZ-1:FORI=1TOJ:IFLEFT$(J$(I),1)<>B$C$(I)=J$(I):NZ(I)=CZ(I)
2140 NEXTI:IFWZ=SZGOTO2170
2150 FORI=WZTOSZ:IFLEFT$(J$(I),1)<>B$R$(I-J)=J$(I):HZ(I-J)=CZ(I)
2160 NEXTI
2170 GOTO2930
2180 !   BALANCE SIDES - ALBUM SEQUENCE
2190 FZ=0:GZ=0:WZ=0:MZ(0)=MZ*.5:FORI=1TOSZ:IFWZ=0ANDFZ+MZ(I)<=MZ(0)FZ=FZ+MZ(I):NEXTI:GOTO2260
2200 !   SET WZ TO START ELEMENT FOR SIDE 2
2210 IFWZ=0WZ=I
2220 !   ACCUM TIME FOR SIDE 2 IN GZ, SIDE 1 IN FZ
2230 GZ=GZ+MZ(I)
2240 NEXTI
2250 !   CHECK TO SEE THAT WE'RE STILL ON THE TAPE
2260 IFMAX(FZ,GZ)>TZGOSUB410:DZ=MZ:MZ=MAX(FZ,GZ)-TZ:GOSUB180:MZ=DZ:PRINTTAB(T)"OVER TAPE LENGTH BY";M;"MIN AND";S;"SEC":PRINT:PRIN
     TTAB(T);:GOSUB550:GOTO3180
2270 !   PLACE SIDE 1 DATA IN C$(X) ARRAY, SIDE 2 IN R$(X) ARRAY
2280 FORI=1TOBZ:C$(I)="":R$(I)="":NZ(I)=0:HZ(I)=0:NEXTI
2290 J=WZ-1:FORI=1TOJ:IFLEFT$(J$(I),1)<>B$C$(I)=J$(I):NZ(I)=CZ(I)
2300 NEXTI
2310 FORI=WZTOSZ:IFLEFT$(J$(I),1)<>B$R$(I-J)=J$(I):HZ(I-J)=CZ(I)
2320 NEXTI:IFFZ>=GZGOTO2380
2330 !   IF SIDE 2 IS LONGER, SWAPS SIDE 1 WITH SIDE 2
2340 GOSUB410:PRINTTAB(T)"Side 2 is longer than Side 1 by";GZ-FZ;"seconds":PRINTTAB(T)"Do you wish to swap recordings now on Side
     2 with those"
2350 PRINTTAB(T)"on Side 1 so side 1 is longer";:GOSUB560:IFA$="N"GOTO2380
2360 !   THIS LINE DOES THE SWAPPING
2370 FORI=1TOSZ:C$=C$(I):NZ=NZ(I):C$(I)=R$(I):NZ(I)=HZ(I):R$(I)=C$:HZ(I)=NZ:NEXTI
2380 GOTO2930
2390 !   BALANCE REGARDLESS OF ANY SEQUENCE
2400 FORI=1TOBZ:C$(I)=Z$:R$(I)=Z$:NZ(I)=0:HZ(I)=0:NEXTI
2410 !   GET TIMING INTO ARRAY FOR MANIPULATION AND SORTING
2420 C=0:FORI=1TOSZ:IFLEFT$(J$(I),1)=B$GOTO2440
2430 C$(I)=FMT(MZ(I),Z$):C=C+MZ(I):NZ(I)=CZ(I)
2440 NEXTI:GOSUB3540
2450 !   FIND HIGH END OF ACTIVE INFORMATION
2460 FORI=1TOSZ:IFC$(I)=Z$I=I-1:GOTO2490
2470 NEXTI
2480 !   SPLIT FOR SIDES OF TAPE, REFERENCE TO HALF OF TOTAL TIME
2490 HZ=I:FZ=0:FORI=HZTO1STEP-1:IFC$(I)<>Z$ANDVAL(C$(I))+FZ<C*.5 R$(I)=C$(I):HZ(I)=NZ(I):C$(I)=Z$:NZ(I)=0:FZ=FZ+VAL(R$(I))
2500 NEXTI
2510 !   GET TOTAL TIME PER SIDE - P=ACCUM C$(X), Q=ACCUM R$(X)
2520 P=0:Q=0:FORI=1TOHZ:IFC$(I)<>Z$P=P+VAL(C$(I))
2530 IFR$(I)<>Z$Q=Q+VAL(R$(I))
2540 !   SET R FOR DIFFERENCE BETWEEN SIDES
2550 NEXTI:S=MAX(P,Q)-MIN(P,Q):IFS=RORP=QGOTO2660
2560 R=S:IFP<QGOTO2620
2570 !   P>Q COMPARE AND RESHUFFLE
2580 FORI=HZTO1STEP-1:IFVAL(C$(I))>RGOTO2600
2590 R$(I)=C$(I):HZ(I)=NZ(I):C$(I)=Z$:NZ(I)=0
2600 NEXTI:GOTO2520
2610 !   Q>P COMPARE AND RESHUFFLE
2620 FORI=HZTO1STEP-1:IFVAL(R$(I))>RGOTO2640
2630 C$(I)=R$(I):NZ(I)=HZ(I):R$(I)=Z$:HZ(I)=0
2640 NEXTI:GOTO2520
2650 !   CHECK TO SEE WE'RE STILL ON THE TAPE
2660 IFMIN(P,Q)<>0ANDMAX(P,Q)<=TZGOTO2710
2670 IFMIN(P,Q)=0PRINTTAB(T)"CANNOT BALANCE SIDES - MUST DELETE SELECTION":GOTO2690
```

More →

Program continued.

```
2680 D%=M%:M%=MAX(P,Q)-T%:GOSUB180:M%=D%:PRINTTAB(T)"OVER TAPE LENGTH BY";M;"MIN AND";S;"SECONDS"
2690 PRINT:PRINTTAB(T)"Restarting system by reading file.":PRINT:PRINTTAB(T);:GOSUB550:CLOSE1:GOTO1760
2700 !   SORT BOTH ARRAYS
2710 GOSUB3540:GOSUB3640
2720 !   MOVE J$(X) DATA INTO C$ AND R$ ARRAYS
2730 FORI=1TOB%:IFC$(I)=Z$C$(I)="\\\":NX(I)=0:GOTO2760
2740 FORJ=1TOS%:IFNX(I)=CX(J)C$(I)=J$(J):GOTO2760
2750 NEXTJ
2760 NEXTI
2770 FORI=1TOB%:IFR$(I)=Z$R$(I)="\\\":HX(I)=0:GOTO2800
2780 FORJ=1TOS%:IFHX(I)=CX(J)R$(I)=J$(J):GOTO2800
2790 NEXTJ
2800 NEXTI
2810 !   SWAP IF SIDE 2 IS LONGER THAN SIDE 1
2820 IFF>0GOTO2850
2830 FORI=1TOS%:C$=C$(I):NX=NX(I):C$(I)=R$(I):NX(I)=HX(I):R$(I)=C$:HX(I)=NX:NEXTI
2840 !   SORT BY ALBUM
2850 GOSUB3640:GOSUB3540
2860 !   REPLACE \ WITH BLANK
2870 FORI=1TOB%:IFC$(I)="\\\"C$(I)=""
2880 IFR$(I)="\\\"R$(I)=""
2890 NEXTI
2900 !   EXIT TO PRINT ROUTINE
2910 GOTO2930
2920 !   PRINT ROUTINES
2930 X$="":GOSUB410:PRINTTAB(T)"Enter Title for Tape";:INPUTW$:OPEN9"*P"PAGESIZE64ENDPAGE3100:GOSUB410:PRINTTAB(T)"Set up Printer
     - Press RETURN When Ready";:INPUTA:GOSUB3120
2940 A=0:B=0:PUT9"Side One":PUT9
2950 M%=0:FORI=1TOS%:IFNX(I)=0GOTO3010
2960 B=VAL(LEFT$(C$(I),2)):IFB<1GOTO2990
2970 IFB=AGOTO2990
2980 A=B:PUT9TAB(5)LEFT$(B$(A),2);TAB(8)D$(A);TAB(49)G$(A)
2990 GET1RECORDNX(I)AX,CX,A$,C$,R$:M%=M%+C%+D:PUT9LEFT$(C$(I),2);TAB(4)MID$(C$(I),3,1);TAB(8)RIGHT$(C$(I),2);TAB(13)C$;:IFX$=R$PUT
     9:GOTO3010
3000 PUT9"    ";R$:X$=R$
3010 NEXTI:M%=M%-D:GOSUB180:PUT9TAB(10)"Total Time Side One = ";FMT(M,"Z9:")+FMT(S,"99"):PUT9REPEAT$(CHAR$(61),80)
3020 A=0:B=0:PUT9"Side Two":PUT9
3030 M%=0:FORI=1TOS%:IFHX(I)=0GOTO3090
3040 B=VAL(LEFT$(R$(I),2)):IFB<1GOTO3070
3050 IFB=AGOTO3070
3060 A=B:PUT9TAB(5)LEFT$(B$(A),2);TAB(8)D$(A);TAB(49)G$(A)
3070 GET1RECORDHX(I)AX,CX,A$,C$,R$:M%=M%+C%+D:PUT9LEFT$(R$(I),2);TAB(4)MID$(R$(I),3,1);TAB(8)RIGHT$(R$(I),2);TAB(13)C$;:IFX$=R$PUT
     9:GOTO3090
3080 PUT9"    ";R$:X$=R$
3090 NEXTI:M%=M%-D:GOSUB180:PUT9TAB(10)"Total Time Side Two = ";FMT(M,"Z9:")+FMT(S,"99"):PUT9REPEAT$(CHAR$(61),80):ENDPAGE9:PUT9:P
     UT9:CLOSE9:ATTRS(1)=F:CLOSE1:GOTO1510
3100 PUT9:PUT9
3110 CLOSE9:OPEN9"*P"PAGESIZE64ENDPAGE3100
3120 PUT9:PUT9
3130 PUT9"Tape Title: ";W$;TAB(55)"Tape Time: ";FMT(T%\B%,"ZZ");" Minutes":PUT9
3140 PUT9"A1";TAB(4)"S";TAB(7)"Band";TAB(31)"Title":PUT9REPEAT$(CHAR$(61),80)
3150 RETURN
3160 !   DELETION ROUTINE
3170 GOSUB410:A$="Delete Titles From Array":PRINTTAB(FNA(A$))A$:PRINT:V%=0
3180 PRINTTAB(T)"All titles will be displayed. You may elect":PRINTTAB(T)"to retain or delete any title":PRINT:PRINTTAB(T);:GOSUB5
     50
3190 FORI%=1TOS%:IFLEFT$(J$(I%),1)=B$GOTO3310
3200 GOSUB410:PRINTTAB(T)"Timing is":PRINT:GOSUB610:PRINT:IFM%>T%*2D%=M%:M%=M%-(T%*2):GOSUB180:PRINTTAB(T)"Delete";M;"Minutes,";S;
     "Seconds or more":PRINT:M%=D%
3210 D%=M%:M%=M%(I%):GOSUB180:M%=D%:PRINTTAB(T)"Selection: ";TAB(T+12)C$(I%):PRINTTAB(T)"Artist: ";TAB(T+12)R$(I%):PRINTTAB(T)"Tim
     e:";TAB(T+12)FMT(M,"Z9:")+FMT(S,"99"):PRINT
3220 PRINT"Enter (D) to Delete, <CR> to Retain, (\) to End Delete Routine":PRINT"or (*) to Restart list from the beginning.";
3230 A$="":INPUTA$:IFA$=""GOTO3310
3240 IFA$=B$GOTO3320
3250 IFA$=CHAR$(42)GOTO3180
3260 IFA$<>"D"GOTO3200
3270 J$(I%)=B$+RIGHT$(J$(I%),4):V%=V%+1:M%=M%-M%(I%):M%(I%)=0
3280 !   M%=TOTAL TIME
3290 !   M%(0)=TOTAL TIME *.5
3300 !   T%=TIME PER SIDE OF TAPE
3310 NEXTI%:GOTO3190
3320 GOTO1920
3330 !   CHANGE FILE ATTRIBUTES TO PERMANENT
3340 GOSUB202:GOSUB410:PRINTTAB(T)"Changing File Attributes to WRITE PROTECT - PERMANENT"
3350 ATTRS(1)=3:CLOSE1:GOTO1510
3360 !   DELETE FILE FROM DISK
3370 GOSUB202:IFF=3GOSUB410:PRINTTAB(T)"PERMANENT FILE - ERASE";:GOSUB560:IFA$="N"CLOSE1:GOTO1510
3380 GOSUB410:PRINTTAB(T)"ERASING FILE - ";RIGHT$(N$,LEN(N$)-2):ATTRS(1)=0:CLOSE1:SCRATCHN$:GOTO1510
3390 !       VARIABLES USED IN INPUT ROUTINE AND FILES
3400 !   J%=0 FOR SINGLE, 1 FOR ALBUM
3410 !   R%=ALBUM NUMBER
3420 !   C$=ALBUM TITLE
3430 !   S$=SIDE - A OR B
3440 !   R$=ARTIST
3450 !   B%=BAND NUMBER
3460 !   M=TIME FOR BAND (IN SECONDS)
3470 !   D=SECONDS ADDED FOR TIME BETWEEN TRACKS
3480 !   FILE STRUCTURE - DATA RECORD
3490 !   RECORD$, TIME, CODE, TITLE, ARTIST
3500 !   FILE STRUCTURE - FINAL RECORD
3510 !   RECORD$, ALBUM$, DUMMY, DUMMY, DUMMY
3520 GOSUB410:A$="Program Terminated":PRINTTAB(FNA(A$))A$:PRINT:PRINT:END
3530 !   SORT FOR C$(X) AND NX(X)
3540 LO=(B%-A%)+1
3550 LO=INT(LO/2)
3560 IFLO=0RETURN
3570 FO=B%-LO:FORDO=A%TOFO:EO=DO+LO
3580 IFC$(DO)<=C$(EO)GOTO3620
3590 F$=C$(EO):HO=NX(EO):GO=DO
3600 C$(EO)=C$(GO):NX(EO)=NX(GO):EO=GO:GO=GO-LO:IFGO>A%-1THENIFC$(GO)>F$GOTO3600
3610 C$(EO)=F$:NX(EO)=HO
3620 NEXTDO:GOTO3550
3630 !   SORT FOR R$(X) AND HX(X)
3640 LO=(B%-A%)+1
3650 LO=INT(LO/2)
3660 IFLO=0RETURN
3670 FO=B%-LO:FORDO=A%TOFO:EO=DO+LO
3680 IFR$(DO)<=R$(EO)GOTO3720
3690 F$=R$(EO):HO=HX(EO):GO=DO
3700 R$(EO)=R$(GO):HX(EO)=HX(GO):EO=GO:GO=GO-LO:IFGO>A%-1THENIFR$(GO)>F$GOTO3700
3710 R$(EO)=F$:HX(EO)=HO
3720 NEXTDO:GOTO3650
```

Line 1840 requests the time for one side of the tape you're going to use and measures the total record time against this figure. If the total record time is longer you may elect to increase the tape time or delete some of the selections. You may also choose to delete entries even though you're within the tape time limitation.

The deletion routine in lines 3160–3320 is easy to understand in that it presents each selection on the console in the order of entry and lets you retain or delete any of them. The time shown as that necessary for deletion is based only on the assumption that all remaining selections will fit on the tape. This is usually a false assumption and you'll probably have to delete one or two more to have it fit. The correct total recording time is entirely dependent on the number of remaining entries, the time of each entry and the method of balancing you choose.

Three methods of balancing are provided, each with its own balancing routine. One thing common between them is at this point the coded record data is in the C$(X) array and the disk file record pointers in the N%(X) array. After balancing, the C$(X)–N%(X) pair will hold those for side one of the tape and the R$(X)–H%(X) pair will hold the data for side two.

Method one (see Sample 1) attempts to fill side one of the tape with as many complete selections as possible, leaving the remaining selections for side two. This is done without altering the sequence of the selections from their original entry sequence, except for the deletions, which are not considered in this balance.

The loop in lines 2040–2080 accumulates the time for each selection in variable F% until such time that it may exceed the length for one side of the tape (T%). At that time subsequent passes will accumulate time in G%. W% becomes the pointer for the starting element for side two. After checking that the total time per side is still within the tape time (line 2100), the selections for each side of the tape are placed into the proper arrays, using the routine in lines 2120–2160. Operation is then transferred to the print routine in line 2930.

Method two (Sample 2) attempts to balance the time on each side without losing the original sequence of the selections. This will result in side one being longer than side two, but with the minimum amount of dead space at the end of side one and the beginning (or end) of side two. This will allow you to splice off the end of the tape for a more professional recording.

The routine in lines 2180–2380 does the balancing and operates in a similar fashion to method one. The main difference is that the time for side one is compared to half the total recording time instead of half the total tape time. This will result in the closest balance possible without altering the sequence.

As it's possible for side two to be longer than side one using this method, the routine in lines 2330–2370 provides an elective means of swapping the selections from side one with those of side two.

Method three (Sample 3) uses the routines in lines 2390–2910 and the sort subroutines in lines 3530–3720. This routine will give you the best possible time balance between both sides of the tape at the expense of changing the sequence of the selections. Since much sorting and data manipulation is required, this tends to be the method taking longest to complete its task.

This method differs from those preceding in that it uses the individual recording times for each selection instead of accumulated time to perform its balance. For this reason, the routine in lines 2410–2440 is used to

```
Al S  Band                        Title
==========================================================================
Side One

    01 SARAH VAUGHAN, RECORDED LIVE - VOL 1      SARAH VAUGHAN
01 A   01   SEPTEMBER IN THE RAIN   SARAH VAUGHAN
01 A   02   JUST ONE OF THOSE THINGS
01 A   03   BE ANYTHING (BUT BE MINE)
01 A   05   STAIRWAY TO THE STARS
01 B   01   LIKE SOMEONE IN LOVE
01 B   02   SPEAK LOW
01 B   04   I'LL STRING ALONG WITH YOU
    02 SARAH VAUGHAN, RECORDED LIVE - VOL 2      SARAH VAUGHAN
02 A   01   THANKS FOR THE MEMORY
02 A   03   MISTY
02 A   04   WHAT IS THIS THING CALLED LOVE
      Total Time Side One = 44:28
==========================================================================
Side Two

    02 SARAH VAUGHAN, RECORDED LIVE - VOL 2      SARAH VAUGHAN
02 A   05   LOVER MAN
02 B   01   SOMETIMES I'M HAPPY
02 B   02   SASSY'S BLUES
02 B   03   POLKA DOTS AND MOONBEAMS
02 B   04   I CRIED FOR YOU
00 A   01   NIGHT TRAIN   EARL BOSTIC
      Total Time Side Two = 26:05
==========================================================================
```

Sample 1. Entering recordings onto tape (method 1).

```
Al S  Band                        Title
==========================================================================
Side One

    02 SARAH VAUGHAN, RECORDED LIVE - VOL 2      SARAH VAUGHAN
02 A   01   THANKS FOR THE MEMORY   SARAH VAUGHAN
02 A   02   I FEEL PRETTY
02 A   03   MISTY
02 A   04   WHAT IS THIS THING CALLED LOVE
02 A   05   LOVER MAN
02 B   01   SOMETIMES I'M HAPPY
02 B   02   SASSY'S BLUES
02 B   03   POLKA DOTS AND MOONBEAMS
02 B   04   I CRIED FOR YOU
00 A   01   NIGHT TRAIN   EARL BOSTIC
      Total Time Side One = 43:46
==========================================================================
Side Two

    01 SARAH VAUGHAN, RECORDED LIVE - VOL 1      SARAH VAUGHAN
01 A   01   SEPTEMBER IN THE RAIN   SARAH VAUGHAN
01 A   02   JUST ONE OF THOSE THINGS
01 A   03   BE ANYTHING (BUT BE MINE)
01 A   04   THOU SWELL
01 A   05   STAIRWAY TO THE STARS
01 A   06   HOW HIGH THE MOON
01 B   01   LIKE SOMEONE IN LOVE
01 B   02   SPEAK LOW
01 B   03   THREE LITTLE WORDS
01 B   04   I'LL STRING ALONG WITH YOU
01 B   05   ALL OF YOU
      Total Time Side Two = 42:53
==========================================================================
```

Sample 2. Method 2.

move the timing data into the C$(X)-N%(X) pair for processing.

Once the arrays are loaded, operation is transferred to the sort subroutine in lines 3530-3620, and the C$(X) array is sorted in ascending order. Since the deleted entries are now clustered at the high end of the array, the loop in lines 2450-2470 can set H% as the pointer for the highest active array element.

The loop in lines 2480-2500 approximates half the total recording time with some selections and moves the remaining selections into the R$(X)-H%(X) pair. The reentrant routine in lines 2510-2560 calculates the total time per side and determines the longest side and the time differential. The time difference is retained in variable R.

Depending upon which side is the longest, operation will transfer to routines in lines 2570-2600 or 2610-2640. These routines will try to find elements of both arrays they can swap that will result in a smaller time differential. The routine in line 2520 is reentered until variable R can no longer be reduced with additional swapping or an exact balance is achieved.

Lines 2650-2690 check for timing errors, and if they exist, the file must be read again and the process repeated. This is because the C$(X) array no longer has the data required for the deletion routine or for method one or two operation.

Once these tests have been passed, the arrays are sorted so any open elements freed by the swapping operation will once again appear in the highest array elements. Lines 2720-2800 move the proper data back into the arrays. Note that three backslashes (\\\) replace the data for those entries that are not included on the tape. This is done so the entries will sort properly when called in line 2850. The backslashes will be replaced with a single blank in lines 2860-2890.

If side one is shorter than side two, the records will be swapped as in method two; however, this will be done automatically since there is no need for an operator decision when using this method.

Printing the Report

The print routine in lines 2920-3150 is straightforward and shouldn't be too hard to convert to other BASICs. After printing the heading, all data pertaining to side one of the tape is printed first, followed by the data for side two. The total time for each side is also printed. The resultant report will become your guide for the recording operation and can be retained for your tape catalog.

The total time per side includes the time (space) you elected to use between selections and will not agree with the total of the individual recording times as entered.

Worthy of note is that Micropolis BASIC allows you to define the printer or console as a file. Such is the case in lines 2930 and 3110 where the printer is defined as file #9.

File Attributes

Micropolis BASIC allows for setting and changing the write protect and erase protect features of any file within a program. This function, although nice to have, isn't required for the operation of the program. If your BASIC doesn't support such a function, all routines and references to them (ATTR and ATTRS) can be removed from the program without harm to its operation.

Conversion Aids

To assist in converting this program to your BASIC, I offer the following definitions of some of the less common statements and keywords used in the program.

- ATTR—Returns the attributes of a file.
- ATTRS(X)—Sets the attributes of a file.
- ENDPAGE—A statement that gives BASIC a line number to GOSUB when the logical end of a page has been reached. Also pages to the end of the logical page when used as a statement.
- ERR, ERR$ and ERROR—Error trapping and printing commands.
- GET—Read a record from a file.
- PAGESIZE—Sets the logical page size for print routines.
- PUT—Write a record to a file.
- PUTSEEK—Set the sequential record pointer for a file.
- RECORD—The random access record number for a GET or PUT.
- RECPUT—Returns the position of the sequential PUT pointer.
- REPEAT$—Repeats a string n times.
- SIZE—Returns the number of records in a file.

The other keywords and statements should be familiar to those programming with extended disk BASIC, offering very few problems in the conversion.

Operation

Since the program is fully prompted, it should not be hard to operate. Upon initialization the system will default to the file creation routine because the file will not be in existence on the disk. From that point on everything should be routine. Remember that nothing is ever deleted from the file so you don't need to reenter existing data when trying different mixes of music.■

```
Al S  Band                          Title
================================================================================
Side One

    01 SARAH VAUGHAN, RECORDED LIVE - VOL 1      SARAH VAUGHAN
01 A   01   SEPTEMBER IN THE RAIN   SARAH VAUGHAN
01 A   02   JUST ONE OF THOSE THINGS
01 A   03   BE ANYTHING (BUT BE MINE)
01 A   04   THOU SWELL
01 A   06   HOW HIGH THE MOON
01 B   01   LIKE SOMEONE IN LOVE
01 B   03   THREE LITTLE WORDS
01 B   05   ALL OF YOU
    02 SARAH VAUGHAN, RECORDED LIVE - VOL 2      SARAH VAUGHAN
02 A   02   I FEEL PRETTY
02 A   04   WHAT IS THIS THING CALLED LOVE
02 B   01   SOMETIMES I'M HAPPY
02 B   03   POLKA DOTS AND MOONBEAMS
02 B   04   I CRIED FOR YOU
         Total Time Side One = 43:24
================================================================================
Side Two

00 A   01   NIGHT TRAIN   EARL BOSTIC
    01 SARAH VAUGHAN, RECORDED LIVE - VOL 1      SARAH VAUGHAN
01 A   05   STAIRWAY TO THE STARS   SARAH VAUGHAN
01 B   02   SPEAK LOW
01 B   04   I'LL STRING ALONG WITH YOU
    02 SARAH VAUGHAN, RECORDED LIVE - VOL 2      SARAH VAUGHAN
02 A   01   THANKS FOR THE MEMORY
02 A   03   MISTY
02 A   05   LOVER MAN
02 B   02   SASSY'S BLUES
         Total Time Side Two = 43:15
================================================================================
```

Sample 3. Method 3.

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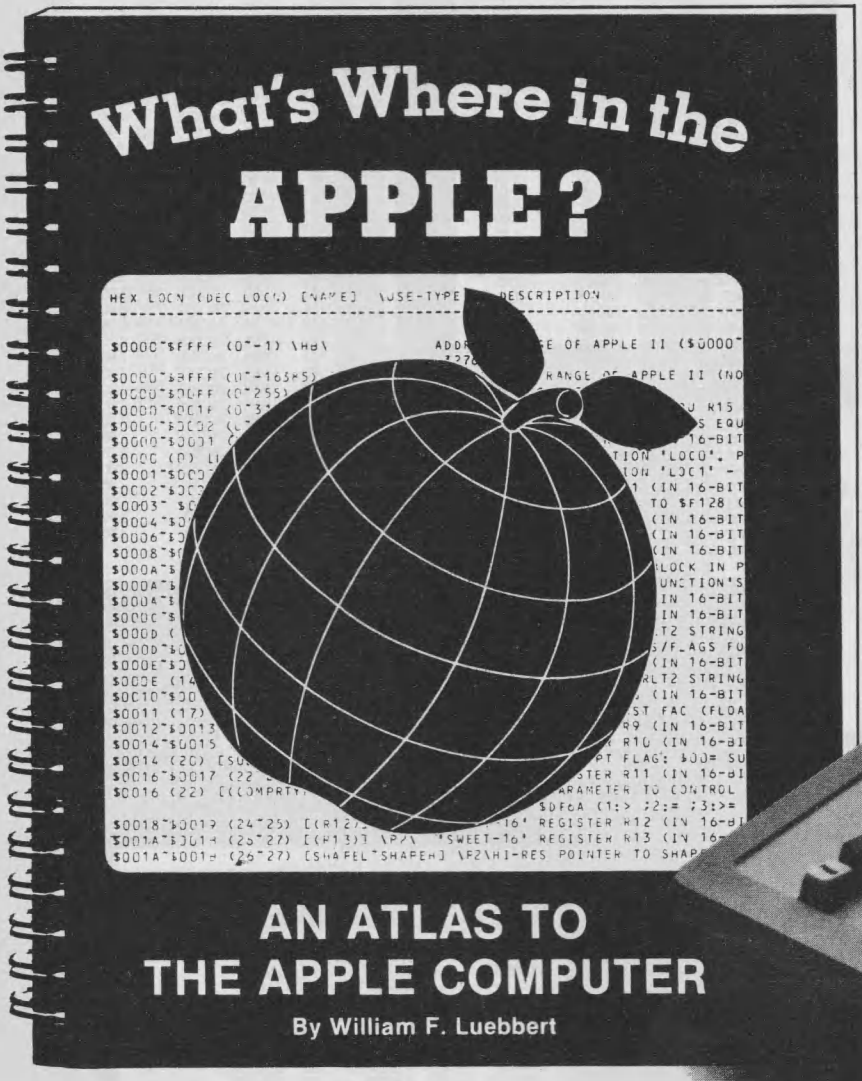

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74LS01	.25	74LS124	2.95	74LS260	.60
74LS02	.25	74LS125	.90	74LS261	2.45
74LS03	.25	74LS126	.80	74LS266	.50
74LS04	.25	74LS132	.75	74LS273	1.60
74LS05	.25	74LS136	.50	74LS275	3.30
74LS08	.30	74LS138	.75	74LS279	.50
74LS09	.25	74LS139	.75	74LS280	1.95
74LS10	.25	74LS145	1.10	74LS283	.95
74LS11	.30	74LS147	2.25	74LS290	1.20
74LS12	.30	74LS148	1.25	74LS293	1.80
74LS13	.40	74LS151	.75	74LS295	1.00
74LS14	.75	74LS153	.75	74LS298	.95
74LS15	.30	74LS155	.90	74LS299	2.50
74LS20	.25	74LS156	.90	74LS323	3.95
74LS21	.30	74LS157	.75	74LS324	1.75
74LS22	.25	74LS158	.75	74LS347	1.95
74LS26	.30	74LS160	.90	74LS348	1.95
74LS27	.35	74LS161	.90	74LS352	1.50
74LS28	.35	74LS162	.90	74LS353	1.50
74LS30	.25	74LS163	.90	74LS363	1.35
74LS32	.35	74LS164	.90	74LS365	.90
74LS35	.55	74LS165	.90	74LS366	.90
74LS37	.50	74LS166	2.00	74LS367	.65
74LS38	.35	74LS168	1.70	74LS368	.65
74LS40	.25	74LS169	1.70	74LS373	1.15
74LS42	.50	74LS170	1.70	74LS374	1.75
74LS47	.75	74LS173	.75	74LS375	.65
74LS48	.75	74LS174	.90	74LS377	1.40
74LS49	.75	74LS175	.90	74LS385	1.85
74LS51	.25	74LS181	2.10	74LS386	.60
74LS54	.35	74LS189	9.95	74LS390	1.85
74LS55	.35	74LS190	.95	74LS393	1.85
74LS63	1.20	74LS191	.95	74LS395	1.60
74LS73	.35	74LS192	.80	74LS399	1.65
74LS74	.40	74LS193	.90	74LS424	2.95
74LS75	.50	74LS194	.95	74LS447	.35
74LS76	.40	74LS195	.90	74LS490	1.90
74LS78	.50	74LS196	.80	74LS630	75.00
74LS83	.75	74LS197	.80	74LS640	3.00
74LS85	1.10	74LS221	1.15	74LS641	3.00
74LS86	.40	74LS240	1.15	74LS642	3.00
74LS90	.60	74LS241	1.15	74LS645	3.00
74LS91	.80	74LS242	1.85	74LS668	1.65
74LS92	.65	74LS243	1.85	74LS669	1.85
74LS93	.60	74LS244	1.00	74LS670	2.15
74LS95	.80	74LS245	1.95	74LS674	9.60
74LS96	.80	74LS247	.75	74LS682	3.15
74LS107	.40	74LS248	1.20	74LS683	2.25
74LS109	.40	74LS249	.95	74LS684	2.35
74LS112	.40	74LS251	1.25	74LS685	2.35
74LS113	.40	74LS253	.80	74LS688	2.35
74LS114	.50	74LS257	.80	74LS689	2.35
74LS122	.45	74LS258	.80		

74S00

74S00	.40	74S163	3.70
74S02	.45	74S168	4.60
74S03	.45	74S169	5.40
74S04	.75	74S174	1.05
74S05	.75	74S175	1.05
74S08	.45	74S181	4.45
74S09	.75	74S182	2.90
74S10	.65	74S188	3.90
74S11	.80	74S189	14.90
74S15	.65	74S194	2.90
74S20	.65	74S195	1.85
74S22	.75	74S196	4.85
74S30	.45	74S197	4.20
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74S40	.40	74S241	3.70
74S51	.75	74S251	1.85
74S64	.75	74S253	7.40
74S65	1.20	74S257	1.35
74S74	.65	74S258	1.45
74S85	2.35	74S260	1.80
74S86	1.40	74S274	19.90
74S112	1.55	74S275	19.90
74S113	1.95	74S280	2.85
74S114	1.45	74S287	4.70
74S124	2.75	74S288	4.40
74S132	1.20	74S289	6.95
74S133	.95	74S301	6.90
74S134	.65	74S373	3.40
74S135	1.45	74S374	3.40
74S138	1.05	74S381	7.90
74S139	1.20	74S387	5.70
74S140	1.40	74S412	2.95
74S151	1.15	74S471	9.90
74S153	1.15	74S472	16.80
74S157	1.15	74S474	17.80
74S158	1.40	74S482	15.50
74S161	2.80	74S570	7.75
74S162	3.70	74S572	7.75

74C00 CMOS

74C00	.35	74C195	2.20
74C02	.35	74C221	2.20
74C04	.35	74C240	2.20
74C08	.35	74C244	2.20
74C10	.35	74C373	2.70
74C14	1.45	74C374	2.70
74C20	.35	74C901	.80
74C30	.35	74C902	.80
74C32	.50	74C903	.80
74C42	1.70	74C904	.80
74C48	2.05	74C905	10.90
74C73	.65	74C906	.90
74C74	.85	74C907	.90
74C76	1.90	74C908	2.00
74C83	1.90	74C909	2.70
74C86	.90	74C910	9.90
74C89	4.50	74C911	9.90
74C90	1.70	74C912	9.90
74C93	1.70	74C914	1.90
74C95	1.70	74C915	1.90
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4007	.35	4044	.85	4506	1.25
4008	.95	4046	.95	4507	.95
4009	.45	4047	.95	4508	1.95
4010	.45	4048	.75	4510	.95
4011	.35	4049	.55	4511	.95
4012	.35	4050	.55	4512	.95
4013	.45	4051	.95	4514	2.25
4014	.95	4052	.95	4515	2.25
4015	.95	4053	.95	4516	1.50
4016	.45	4055	2.75	4518	1.25
4017	.95	4056	2.75	4519	1.25
4018	.95	4059	9.95	4520	1.25
4019	.45	4060	1.25	4522	1.25
4020	.95	4066	.75	4526	1.25
4021	.95	4068	.40	4527	1.75
4022	.95	4069	.40	4528	1.25
4023	.35	4070	.40	4531	.95
4024	.75	4071	.30	4532	1.75
4025	.35	4072	.30	4539	1.75
4026	1.95	4073	.30	4543	1.95
4027	.65	4075	.30	4553	4.95
4028	.80	4076	.95	4555	.95
4029	.95	4078	.50	4556	.95
4030	.45	4081	.40	4558	2.25
4031	1.50	4082	.40	4568	5.95
4032	2.75	4085	.95	4581	1.95
4033	2.75	4086	.95	4582	1.95
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Bubble vs straight insertion vs quick. When do you use them and which one is best?

Sorting Techniques Explained

By H.S. Gentry

If you write software for any type of computer, sooner or later you'll need to sort data. Some sorting techniques are better than others, but why? When do you use the various techniques? Is any one technique good enough to use as your standard sorting algorithm? Here's a rundown of the different kinds of sorting, and their applications.

The Bubble Sort

I learned the bubble sort technique first. It's called that because the elements that belong at the top of the list "bubble" up with each pass through the algorithm.

Using the bubble sort is simple. You go through the list n times (n is the number of items to be sorted), checking each item in the list with the next item and exchanging them if they aren't in the proper order. As you can see from Listing 1, this makes a very compact sorting program. Lines 1000–2000 do the actual sorting.

You can also see that the algorithm will always make n squared compares (n items checked n times). Thus, even if your data is already sorted (or nearly so), it will still take a long time to finish.

This algorithm can be improved with the addition of a flag to check for one complete pass through the data with no exchanges. When this condition is detected the data is sorted, no matter if this is the first or nth pass. Listing 2 is the same program changed to use this flag technique.

The bubble sort can be further modified to improve its performance, but there is another, better sorting algorithm.

The Straight Insertion Sort

The straight insertion sort is almost as easy to implement as the bubble sort, and will almost always give faster results. (The only exception is when the data to be sorted is already in sort.)

The straight insertion sort passes through the data one time, takes each element and looks back from its location to find where it belongs. For example, sort the following data in ascending order:

6 1 8 4 9 3

Start with the second item (1) and

```
10 DIM D(100)
15 REM - GENERATE 101 RANDOM NUMBERS TO BE SORTED
20 FOR I = 0 TO 100
30 D(I)=RND(0)
40 NEXT I
1000 REM THIS IS THE BUBBLE SORT
1010 FOR I = 0 TO 100
1020 FOR L = 0 TO 100-1
1030 IF D(L) >-D(L+1) THEN W=D(L): D(L)=D(L+1): D(L+1)=W
1040 NEXT L
1050 NEXT I
2000 REM THIS IS THE END OF BUBBLE SORT
9999 END
```

Listing 1. Simple bubble sort.

```
10 DIM D(100)
15 GENERATE 101 RANDOM NUMBERS TO BE SORTED
20 FOR I = 0 TO 100
30 D(I)=RND(0)
40 NEXT I
1000 REM - THIS IS THE BUBBLE SORT WITH FLAG
1005 F=0
1010 FOR I = 0 TO 100
1020 FOR L = 0 TO 100-1
1030 IF D(L) > D(L+1) THEN W=D(L): D(L)=D(L+1): D(L+1)=W:F=1
1040 NEXT L
1050 IF F=0 THEN 2000 ELSE F=0: NEXT I
2000 THIS IS THE END OF BUBBLE SORT WITH FLAG
9999 END
```

Listing 2. Bubble sort with flag.

Address correspondence to H.S. Gentry, Route 1, Box 39B, Earlysville, VA 22936.

compare it to the first (6). If these two items are in order, go on to the next item. If they are not in order, which is the case here, then exchange them. We get:

1 6 8 4 9 3

Now move on to the third item (8). It's in order, so leave it alone and move on to the fourth (4). It's not in order; look back until you find the place it belongs. The result:

1 4 6 8 9 3

Repeat this for the last two items. You'll end up with:

1 3 4 6 8 9

Listing 3 is the straight insertion sort algorithm implemented in BASIC. Lines 1000–2000 are the actual sort. It's almost as easy as the bubble sort and much faster.

How much faster? The bubble sort algorithm with the flag took 210 seconds to sort 100 random numbers (on a TRS-80 Model I). It took 888 seconds to sort 200 random numbers. The straight insertion sort took 87 seconds to sort 100 numbers and 329 seconds to sort 200 numbers.

Quicksort

Until recently I used one of the above techniques to do all of my sorting, and then I learned about quicksort.

Quicksort was invented by C. A. R. Hoare. Unlike the bubble or straight insertion sort, quicksort is not exactly intuitive. That is, if I tried to think of a way to sort data, the quicksort algorithm would not come to mind.

Quicksort works by selecting an item at random from the list to be sorted, and then partitioning the data into two groups. One group has elements greater than the selected element and one group has elements less than the selected element. These two partitions are then subjected to this same algorithm, as are the four resulting partitions, and so on until each partition has only one element. At this time the data will be in sort.

Let's look at a simple example. Sort the following data in ascending order:

6 1 8 4 9 3

First pick an element at random; e.g., 4. Then start at the low end and at the high end, and exchange elements that are on the wrong side. You get:

3 1 8 4 9 6

Then:

3 1 4 8 9 6

Now you have two partitions:

3 1 4 and 8 9 6

Work on the 314 partition. Pick 1 as the test element and you get 1 and 3 4 as the two partitions. Work on 3 4 to get 3 and 4 as the two partitions. You now have four partitions:

1, 3, 4, 8 9 6

You must go back to 8 9 6 and work to get 6 8 and 9. Then:

6, 8, 9

Put all of this together and you have:

1, 3, 4, 6, 8, 9

and the data is sorted.

The hard part is keeping track of all of the partitions that result from each pass and making sure that all of them are processed. This can be done in two ways.

The hardest way is used in a programming language that does not allow recursive calls to subroutines. That is, a subroutine may not call itself. In this case you must keep

```
10 DIM D(1000)
15 REM - GENERATE 1001 RANDOM NUMBERS TO BE SORTED
20 FOR I = 0 TO 1000
30 D(I)=RND(0)
40 NEXT I
1000 REM - THIS IS THE STRAIGHT INSERTION SORT
1100 FOR J = 1 TO 1000
1110 K=D(J)                              'FIND A PLACE FOR THIS ITEM
1120 FOR L = J-1 TO 0 STEP -1            'BACK UP UNTIL WE FIND PLACE
1130 IF K > D(L) THEN D(L+1)=K: GO TO 1200   TERMINATE LOOP
1140 REM - WHEN WE GET HERE THE LAST SLOT WAS NOT THE PLACE
1141 REM - SO WE WILL MOVE UP ONE PLACE
1150 D(L+1)=D(L)
1160 NEXT L                              'GO BACK TO TRY AGAIN
1161 REM - THE ABOVE LOOP WILL BE REPEATED UNTIL A PLACE IS
1162 REM - FOUND OR THE LOOP RUNS OUT.  IF THIS HAPPENS
1163 REM - THEN THE PROPER PLACE IS AT THE BEGINNING OF
1164 REM - THE LIST.
1180 D(0)=K                              'PUT IT AT THE TOP OF LIST
1200 NEXT J                              'ON TO NEXT ITEM TO BE SORTED
2000 REM - THIS IS THE END OF STRAIGHT INSERTION SORT
9999 END
```

Listing 3. Straight insertion sort.

```
5 REM - SL IS THE ARRAY STACK FOR THE LEFT PARTITION BOUND
6 REM - SR IS THE ARRAY STACK FOR THE RIGHT PARTITION BOUND
7 REM - S IS THE POINTER TO THE NEXT POSITION IN THE STACKS
10 DIM D(1000),SL(20),SR(20)
15 REM - GENERATE 1001 RANDOM NUMBERS TO BE SORTED
20 FOR I = 0 TO 1000
30 D(I)=RND(0)
40 NEXT I
1000 REM - THIS IS NONRECURSIVE QUICKSORT
1004 REM - INITIALIZE THE STACKS WITH FIRST AND LAST TO START
1005 S=1: SL(1)=0: SR(1)=1000
1006 L=SL(S): R=SR(S): S=S-1   'POP TOP REQUEST FROM STACK
1007 REM - L=LEFT BOUND OF PARTITION TO BE PARTITIONED
1008 REM - R=RIGHT BOUND OF PARTITION TO BE PARTITIONED
1010 REM - NOW WE WILL PARTITION
1020      I=L:J=R
1030          X=D((I+J)/2)   'SELECT MIDDLE VALUE
1040              IF D(I) < D THEN I=I+1: GOTO 1040
1050              IF X < D(J) THEN J=J-1: GOTO 1050
1051 REM - THE LAST TWO LINES SELECTED AN ELEMENT IN THE
1052 REM - UPPER HALF THAT BELONGS IN THE LOWER AND IN THE
1053 REM - LOWER HALF THAT BELONGS IN THE UPPER
1056              IF I <= J THEN 1060 ELSE 1100
1060                  W=D(I):D(I)=D(J):D(J)=W 'EXCHANGE
1070                  I=I+1:J=J-1
1100          IF I>J THEN 1110 ELSE 1040
1110          IF I < R THEN S=S+1: SL(S)=I: SR(S)=R
1111 REM - THE LAST LINE PUSHED A PARTITION REQUEST ON THE
1112 REM - STACK. NOW WE WORK ON THE OTHER ONE.
1120            R=J
1130      IF L >= R THEN 1140 ELSE 1020
1139 REM - NOW WE SEE IF ANY REQUESTS ARE ON THE STACK
1140 IF S = 0 THEN 2000 ELSE 1006
2000 REM - THIS IS THE END OF QUICKSORT
9999 END
```

Listing 4. Nonrecursive sort.

track of each partition and make sure it is sorted. This is done with a stack (actually, two stacks). When you finish with each pass through the algorithm, you put the pointers to the right-most partition on the stacks and process the left partition again. When you work your way to the left end of the list, you pop a partition off the stack and start again. When no pointers remain on the stack, the data has been sorted.

When you pick the size for the stack, you must guess a little. If you're very lucky and the partitions split the data exactly in two every time, the stack must be only LOG(n) (n is the number of items to be sorted). If you're not so lucky and each makes the right partition (the one placed on the stack) one element, then the stack must be n long. Both of these conditions are almost impossible, and I find that a stack of a little more than LOG(n) works well. That is, for 1000 items to be sorted, a stack of 20 is more than enough.

Listing 4 is the nonrecursive Quicksort algorithm implemented in BASIC. Lines 1000–2000 form the actual sorting algorithm. Lines 1010–1070 perform the partitioning of the data into two groups—one greater than X and one less than X. X was chosen as the middle value in the data, although almost any value will work (some texts use the median value). The partitioning takes place by starting at both ends of the data and exchanging elements that are on the wrong side of X. At the end of this operation, I and J point to the two partitions. One of these is placed on the stack while the other is processed.

Quicksort will sort 100 random numbers in 32 seconds (as opposed to 210 for the bubble sort and 87 for the straight insertion sort). Quicksort will sort 600 numbers in 206 seconds. Straight insertion sort took 2809 seconds (I did not run bubble sort on this number of items but it would have taken over 10,000 seconds). It sorted 1000 numbers in 375 seconds, while straight insertion sort would take over 7000 seconds. In fact, the straight insertion sort time will increase as the square of the number of elements, while quicksort will increase as nLOG(n).

If you can implement Quicksort in a language like Pascal, which allows recursive calls to subroutines (or procedures), then the algorithm is greatly simplified. Listing 5 is the same algorithm written in Pascal using the recursive feature. You don't need to keep track of the partitions to be worked on since the sort procedure calls itself recursively until all partitions are done.

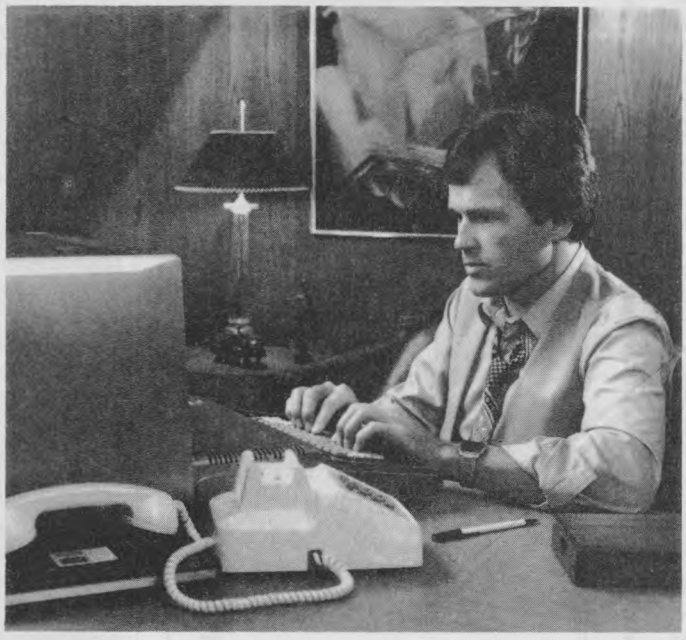
Quicksort may sound like the answer to a programmer's prayer; it's quick and not too complicated. But it does have a few problems. If the data to be sorted is already in sort, it is slower than the bubble sort (with flag) and the straight insertion sort. Also, if each time the algorithm selects a value for X it selects the largest value in the partition, Quicksort becomes very slow. Fortunately both of these conditions are not very likely.

```
PROCEDURE SORT (L,R: INTEGER);
    VAR I,J,X,W: INTEGER;
BEGIN I:=L; J:=R;
    X:= A[(L+R) DIV 2];
    REPEAT
WHILE A[I]<X DO I:=I+1;
        WHILE X<A[J] DO J:=J-1;
        IF I<=J THEN
        BEGIN W:=A[I];
            A[I]:=A[J];
            A[J]:=W
            I:=I+1; J:=J-1;
        END
    UNTIL I>J;
    IF I<J THEN SORT(L,J);
    IF I<R THEN SORT(I,R);
END;
```

Listing 5. Recursive Quicksort written in Pascal.

```
5 REM - SL IS THE ARRAY STACK FOR THE LEFT PARTITION BOUND
6 REM - SR IS THE ARRAY STACK FOR THE RIGHT PARTITION BOUND
7 REM - S IS THE POINTER TO THE NEXT POSITION IN THE STACKS
10 DIM D(1000),SL(20),SR(20)
15 REM - GENERATE 1001 RANDOM NUMBERS TO BE SORTED
20 FOR I = 0 TO 1000
30 D(I)=RND(0)
40 NEXT I
1000 REM - THIS IS NONRECURSIVE QUICKSORT
1004 REM - INITIALIZE THE STACKS WITH FIRST AND LAST TO START
1005 S=1: SL(1)=0: SR(1)=1000
1006 L=SL(S): R=SR(S): S=S-1  'POP TOP REQUEST FROM STACK
1007 REM - L=LEFT BOUND OF PARTITION TO BE PARTITIONED
1008 REM - R=RIGHT BOUND OF PARTITION TO BE PARTITIONED
1010 REM - NOW WE WILL PARTITION
1011 REM - BUT FIRST CHECK IF WE SHOULD USE SIS
1015 IF R-L < 22 THEN 3000 'IF WE HAVE 22 OR LESS USE SIS
1020     I=L:J=R
1030         X=D((I+J)/2)  'SELECT MIDDLE VALUE
1040             IF D(I) < X THEN I=I+1: GOTO 1040
1050             IF X < D(J) THEN J=J-1: GOTO 1050
1051 REM - THE LAST TWO LINES SELECTED AN ELEMENT IN THE
1052 REM - UPPER HALF THAT BELONGS IN THE LOWER AND IN THE
1053 REM - LOWER HALF THAT BELONGS IN THE UPPER
1056             IF I <= J THEN 1060 ELSE 1100
1060                 W=D(I):D(I)=D(J):D(J)=W 'EXCHANGE
1070                 I=I+1:J=J-1
1100         IF I>J THEN 1110 ELSE 1040
1110         IF I < R THEN S=S+1: SL(S)=I: SR(S)=R
1111 REM - THE LAST LINE PUSHED A PARTITION REQUEST ON THE
1112 REM - STACK. NOW WE WORK ON THE OTHER ONE.
1120         R=J
1130     IF L >= R THEN 1140 ELSE 1020
1139 REM - NOW WE SEE IF ANY REQUESTS ARE ON THE STACK
1140 IF S = 0 THEN 2000 ELSE 1006
2000 END     ' QUICKSORT/SIS IS FINISHED
3000 FOR J = L+1 TO R
3010 K=D(J)
3020 FOR L1 = J-1 TO L STEP -1
3030 IF K > D(L1) THEN D(L1+1)=K: GOTO 3200
3050 D(L1+1)=D(L1)
3060 NEXT L1
3080 D(L1)=K
3200 NEXT J
3210 GOTO 1140
9999 END
```

Listing 6. Quicksort and straight insertion sort.



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Another problem with Quicksort is that it does not perform very well with a small number of items. This can be improved by checking the size of each partition and converting to a straight insertion sort if the number of items is less than about 22. Listing 6 is the same Quicksort program in Listing 4, modified to use the straight insertion sort for small partitions. This change makes the algorithm about 8 percent faster with 500 elements to be sorted and almost 14 percent faster with 500 elements.

Conclusion

Several other fast algorithms for sorting exist, but none of them is faster than Quicksort. Use the straight insertion sort technique when you want to sort a small amount of data or when you want a simple program, and use the Quicksort (or Quicksort/straight insertion combination) when you need a very fast sort for large amounts of data. These two techniques will give you all the sorting tools you need.

If you would like to know more about these or other sorting algorithms, see *Algorithms + Data Structures = Programs* by Nicklaus Wirth. ■

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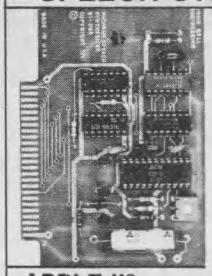

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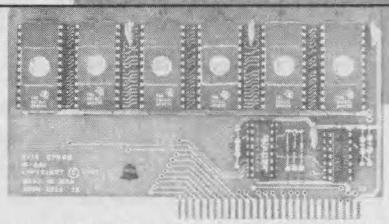

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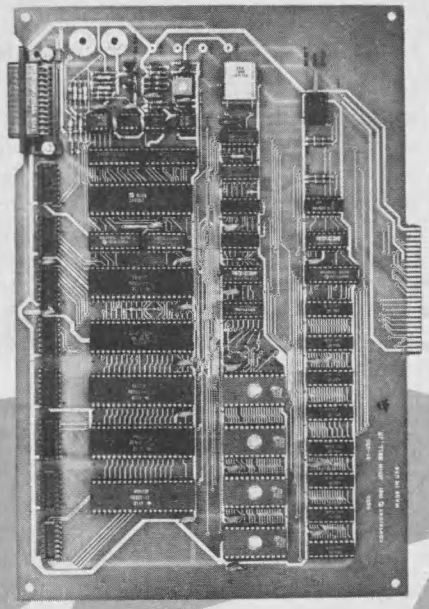

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Here are the necessary changes to run Quest Electronics' editor/assembler on the Elf II.

1802 Editor/Assembler

By Barry Erick

The Quest Electronics Editor/Assembler is for any 1802, so they issue the I/O and break routines to the user. But while they supply sample I/O routines, these have to be modified for use with the Elf-II and VID board. The following changes will get the Editor/Assembler up and running.

Serial I/O

First enter the serial I/O as listed in Quest's Editor/Assembler manual, page 8-8, in memory locations 0A00 to 0AF7 (hexadecimal). Then change all data in the serial I/O as listed in Table 1. Also enter the Register Save and Reset routine as listed in the same table. This is necessary to save R F.0, which is used in the Serial I/O routines, but not saved and reset in the built-in register routines in the Serial I/O routine.

This gives you the necessary serial I/O needed to operate the Editor/Assembler. The data rate must be added though, along with the Break routine. I also added a routine to check for form feed (CLS) and provide the delay necessary when the VID board is used. This is necessary because the VID board can take 1.5 seconds to erase the entire screen; and if the delay isn't provided, some characters would be lost, since the computer is outputting characters while the VID board is still erasing.

```
026E   09 52
08B0   09 73
0950   80 55
0952   8F 73 9F D4 0A 09
0958   12 F0 AF 9F D5
0973   8F 73 9F D4 0A
0978   06 12 F0 AF 9F D5
0A01   0A
0A04   0A
0A15   09
0A18   50
0A28   3F
0A36   37
0A58   30
0A94   0A
0AA3   3F
0AA8   37
0AAD   3F
0AB2   37
0AB7   3F
0AC2   09
0AC5   50
```

Table 1. Changes and additions to the Editor/Assembler and Serial I/O necessary to run it on an Elf II.

```
0000    F8 06 A3 F8 00 B3 D3 C0
0008    0A 00
0ACC    00
Original:
0000    F8 0D C8 F8 00 A6 F8 0D
0008    A3 F8
0ACC    D5
```

Table 2. Data Rate Find program and the original bytes which must be reinserted after finding the data rate.

The Data Rate

First, so that the data rate is correct from a warm start, I keep the data rate constants in memory at program location 0950 and 0951 (hexadecimal). This is reflected in the serial I/O by the changes at 0A15, 0A18, 0AC2 and 0AC5. To find the constant for any other rate, enter and run the program in Table 2. When entered, hit the return key. This will compute and automatically place the correct data rate constants in the program memory, and the program will halt. Be sure to

```
093D    09 90
0946    60
0960    FB 0C 32 66 30 3F F8 40
0968    BF 2F 9F 3A 69 F8 0C BF
0970    30 3F
0990    D4 09 3F 45 4C 46 20 49
0998    49 20 6D 6F 64 73 20 62
09A0    79 20 42 41 52 52 59 20
09A8    45 52 49 43 4B 0D 00 C0
09B0    00 B0
```

Table 3. The CLS delay routine, plus a headline.

Address correspondence to Barry Erick, 28 Ridge St., Dallas, PA 18612.

change 0ACC to 00 before you run the Data Rate Find program to kill the program, and to change 0ACC back to its original value (D5) after. Also be sure to reenter the first ten locations of the Editor/Assembler program to their original value. (The "find the data rate" portion of the serial I/O is used only this one time.)

CLS Delay

To provide a delay on the CLS (form feed) routine, I changed the character output routine to check for a 0C (ASCII form feed) after it has been output to the Serial Out routine and returned to the main program. If found, a delay routine is entered to waste some time while the VID board catches up. The output character is passed to, and returned from, the Serial Out routine in both the D register and RF. 1. The changes needed to add this feature are listed in Table 3.

The Break Routine

Quest also provided space in the Editor/Assembler for a Break routine, which you must write. (They do provide a sample listing, but it won't help the Elf II user.) Using only the hex input key usually provides a break that aborts any listing. Sometimes, though, especially if you don't have hard copy, you would like to just momentarily stop the listing in progress, and then resume. The routine I wrote gives you just such an option. Pressing the input key during a listing gives us a break, and the Break routine then waits for an input from the ASCII keyboard. If a space is encountered, the listing continues. But if a Return is entered, the listing aborts. (Any other entry is nearly ignored.) The Break routine, and changes needed in the Editor/Assembler, are listed in Table 4.

Monitor Jump

As stated, a monitor jump has to be provided. Table 5 shows the changes to be made to the program, to be able to jump into the Netronics Monitor at F000.

Moving into EPROM

I have my copy of Quest's Editor/Assembler resident in EPROM. Since the Editor/Assembler is not written in relocatable code, all address reference data had to be searched for and changed to the new page. It turns out that after starting and searching, I found 180 changes to make to move the Editor/Assembler into EPROM. Those changes are shown in Table 6.

Memory Allocation

In either the RAM version or in the EPROM version of the Editor/Assembler, attention must be given to memory allocation. Table 7 gives my recommended locations. Refer to Quest's manual, page 5-2, for the addresses of the program that you need to change. Note that for the EPROM version, the addresses to be changed are found by adding the EPROM starting address to the printed address. Also, in the EPROM version, the label table I recommend is two pages long while Quest recommends one page. I did this when I quickly ran out of label space. Two pages let you produce about 64 labels.

Conclusion

After you make the changes necessary to get Quest's Editor/Assembler up and running on your Elf II (whether or not you put it in EPROM), assemble some programs using the Editor/Assembler. I think that you'll agree that it's much easier to do this than to use machine code to write a program (unless the program is very short).■

The Editor/Assembler is available for $25 from Quest Electronics, PO Box 4438, Santa Clara, CA 95854.

089D	0A 03
08A0	09 7E
097E	D4 09
0980	52 FB 20 C2 08 A2 FB 2D
0988	C2 00 03 30 7E
0AF3	3F FA F8 00 FF
0AF8	00 D5 F8 00 FC 00 D5 00

Table 4. The Break routine.

0478	08 A5
08A5	F8 00 A0 F8 F0 B0 E0 D0 00

Table 5. The Monitor jump listing.

Table 6. The changes necessary to place the Editor/Assembler in EPROM. "X" is the first page of the EPROM address. Ex: Editor is to be in EPROM at C000 to CAFF. In this example X = C0; X + 8 = C8; etc.

000A=X	000E=X+8	001E=X+3	0028=X+2
002D=X+2	0030=X+2	0046=X+4	0054=X+3
0062=X+2	0067=X+7	006A=X+4	006D=X+2
0070=X+1	0075=X+8	0078=X+1	007D=X+1
0080=X+2	0084=X+1	008A=X+2	0094=X+4
0099=X+2	009C=X+2	00A6=X+1	00A9=X+1
00AE=X+8	00B9=X+2	00BC=X+2	00C1=X+2
00C4=X+2	00CC=X+2	00D9=X+4	00DE=X+2
00E9=X+1	00EF=X+1	00FB=X+2	0101=X+1
0104=X	0138=X+2	013E=X+2	015C=X+8
0165=X+2	016D=X+2	0187=X+2	0190=X+1
0197=X+2	019A=X+1	01A0=X+2	01CD=X+1
01D0=X+2	01F8=X+2	01FF=X+1	0202=X+1
020D=X+4	0210=X+2	023B=X+2	024E=X+2

More →

Table 6 continued.

```
0257=X+7    025E=X+4    0263=X+2    026B=X+8
026E=X+9    0279=X+2    028E=X+2    02A7=X+8
02DC=X+3    02DF=X+4    02E2=X+3    02E5=X
02F6=X+3    0302=X+2    031A=X+2    031A=X+2
031D=X+1    032A=X+1    0339=X+3    0347=X+7
034C=X+3    0373=X+3    039A=X+1    039F=X+6
03A4=X+5    03A7=X+2    03AB=X+8    03AF=X+5
03B5=X+2    03D3=X+5    03EF=X+3    03F2=X+3
03F5=X+4    03FE=X+4    041A=X+5    041E=X+3
0421=X+3    0424=X+3    0427=X+3    0440=X+5
0462=X+2    0466=X+3    046C=X+3    0474=X
0478=X+8    047B=X      047E=X+1    048B=X+2
048E=X+2    0497=X+3    049C=X+3    049F=X+3
04BE=X+2    04CC=X+2    04D4=X+3    04DD=X+3
04E7=X+3    04F9=X+8    0505=X+3    0511=X+1
0515=X+3    0518=X+4    052D=X+3    0549=X+3
055A=X+4    0560=X+5    0564=X+3    0579=X+4
057E=X+1    0582=X+3    0585=X+4    0588=X+4
05A4=X+7    05A7=X+4    05B3=X+5    05B9=X+1
05BE=X+4    05C3=X+5    05DA=X+2    05DD=X+1
05E8=X+5    05EB=X+3    05F8=X+5    05FC=X+5
07E1=X+2    07F2=X+5    07FE=X+2    0835=X+2
0841=X      0848=X+2    0873=X+3    087A=X+2
087D=X+2    0880=X+2    0883=X+2    0886=X
0889=X+2    088C=X+2    088F=X+2    0892=X+2
0895=X+2    089A=X+5    089D=X+A    08A0=X+9
08A3=X+3    08B0=X+9    08BF=X+4    08C2=X+2
08CD=X+2    08E6=X+3    08E9=X+4    08EF=X+9
097F=X+9    0984=X+8    0989=X      098C=X+9
0991=X+9    09B0=X      0A15=X+9    0AC2=X+9
```

```
(a)
xy3D=Stack
xy00=Text Buffer
0C00=Source/Object Code
0B00=Label Table
0000=Editor/Assembler
```

```
(b)
xy3D=Stack
xy00=Text Buffer
0200=Source/Object Code
0000=Label Table
```

Table 7. The typical memory allocations, where "xy" is the last RAM page in memory. Table 7a shows the RAM version, while 7b shows the EPROM version.

↙See List of Advertisers on page 210

Here's an artful application of the TVBUG that turns your micro into a color slate to draw pictures.

Parti-Colored Picture Pad

By M. L. Shore and L. K. R. Williams

We had finished building the Motorola TVBUG, and the world of electric color was at our fingertips. Exploiting the system's color graphics abilities was just a question of providing a substantial amount of software support.

The program described here uses the computer as a color slate for drawing pictures. Drawing is done by picking a color via the keyboard, and holding down one of the four cursor-control keys. A pseudo-color (cursor skip) lets you move the cursor around without disturbing the picture. A cursor home key lets you place the cursor at the top left-hand pixel (picture element) of the screen.

A number of special function keys (see Table 1) let you break out of the graphics mode, save pictures and restore them. It is heartbreaking to spend hours composing a modern-day Mona Lisa, only to switch the machine off. The storage-and-retrieval feature is useful for demonstrating the graphics capabilities of the TVBUG system.

TVBUG

The TVBUG system allows for 12 different video-display graphics (VDG) modes—two alphanumeric, two semigraphics and eight graphics (see Table 2). The normal working mode of the system is, predictably, alphanumeric internal. The graphics mode we have chosen for this application is graphics 2C. In this mode the screen is divided into a 128 by 64 pixel array, held in memory as 2K bytes. Each byte represents four pixels in a horizontal row. The graphics 2C mode can be used with one of two color sets (but not both): green, red yellow and blue or buff, orange, cyan and magenta. You choose the color set when the system is put into graphics mode via a memory-mapped pin on the VDG chip.

Command	Function
Esc	revert to monitor
Q	revert to start of program
S	store current picture
L	put stored picture back onto screen
C	select cursor-skip
G	select green/buff
R	select red/orange
Y	select yellow/cyan
B	select blue/magenta

Table 1. Keyboard commands.

Cursor Keypad

Although it's not included as part of the TVBUG kit, you can attach a cursor-control keypad to the system. The five cursor-control pins on the keyboard connector are attached to 10k resistors, which go to ground. They also connect to one side of a normally open switch (the cursor-control key). The other side of this switch is con-

Mode	Description	Color set
alphanumeric internal	32×16	—
alphanumeric external	32×16	—
semigraphics 4	64×32	all eight
semigraphics 6	64×48	green yellow blue red
graphics 1C	64×64	green yellow blue red
graphics 1R	128×64	green black
graphics 2C	128×64	green yellow blue red
graphics 2R	128×96	green black
graphics 3C	128×96	green yellow blue red
graphics 3R	128×192	green black
graphics 6C	128×192	green yellow blue red
graphics 6R	256×192	green black

Table 2. VDG modes.

Address correspondence to M. L. Shore and L. K. R. Williams, Defence EDP, PO Box 50247, Porirua, New Zealand.

nected to a +5 V supply (see Fig. 1).

The Program

The layout of the program is described in Fig. 2. As you can see, subroutines are not called directly but via a subroutine-jump table. This lets you relocate subroutines safely, and was invaluable in program testing.

The initialization phase of the program is 0100 through 0150 (hexadecimal). This phase puts a heading on the screen, and asks for the color set. The reply is decoded and stored as the VDG mode byte. Then the background color is requested, the answer decoded and a four-pixel color byte stored. The program is then put into graphics mode by altering locations F441 through F443, the screen is filled with the background color and the cursor is homed.

0151 through 018F represents the main program-control loop, shown in flowchart form in Fig. 3. The keyboard input byte is mapped to F404, and the cursor keypad input to F406. Little needs to be explained about this control loop—it is quite straightforward. Note the use of a complemented pixel as the cursor.

The decode-color subroutine, 0193 through 01B3, uses the hexadecimal representation of the four color codes —GRYB (green, red, yellow, blue)—to generate the correct VDG two-bit code for the pixel. Note that the subroutine generates a byte full of these pixels.

The move-cursor routine, 01B8 through 01E4, is outlined in the flowchart in Fig. 4. When designing the system, we decided to hold the cursor position as an (x,y) coordinate pair, rather than as an address and pixel position. This makes cursor movement easy but requires address and mask generation for each screen access. In practice the (x,y) coordinate-pair method was simple and effective. Note the use of (x,y) coordinate masks in the subroutine which provide horizontal and vertical wraparound.

01EB through 0222 contains the get-screen-address-and-mask subroutine. This is represented as a flowchart in Fig. 5, and is relatively simple.

0229 through 0240 is the string-out subroutine used to place the program heading and question strings on the screen at a specified position (bytes 0010,0011). The subroutine merely copies bytes from one memory location to another.

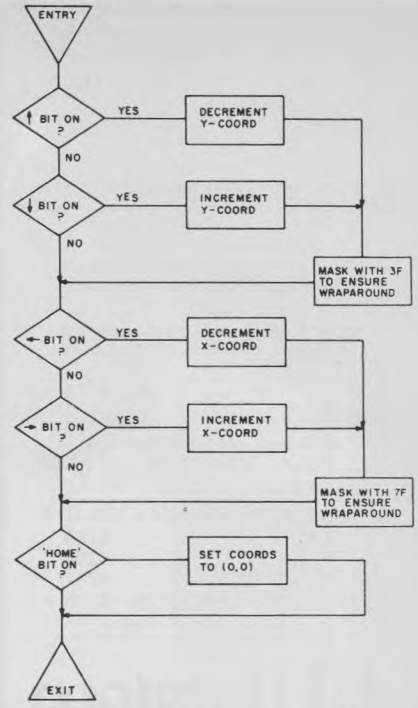

Fig. 4. Move cursor.

The store-pixel routine, 0247 through 026A, puts a pixel onto the screen. As can be seen from Fig. 6, this involves getting the screen byte,

(text continued on page 174.)

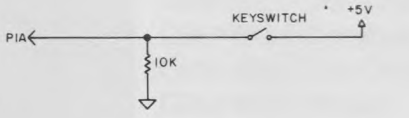

Fig. 1. Cursor-control key circuitry.

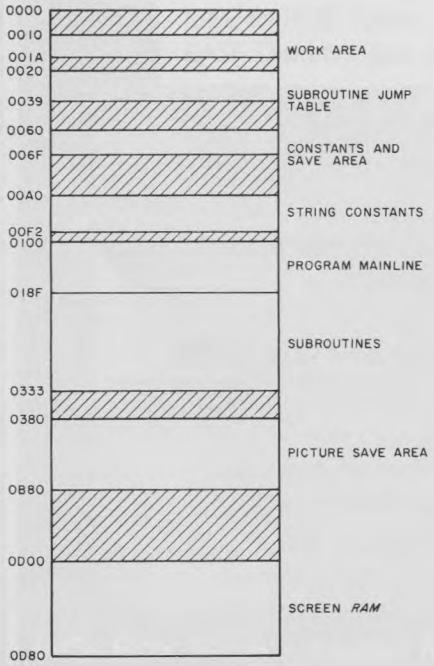

Fig. 2. Program layout.

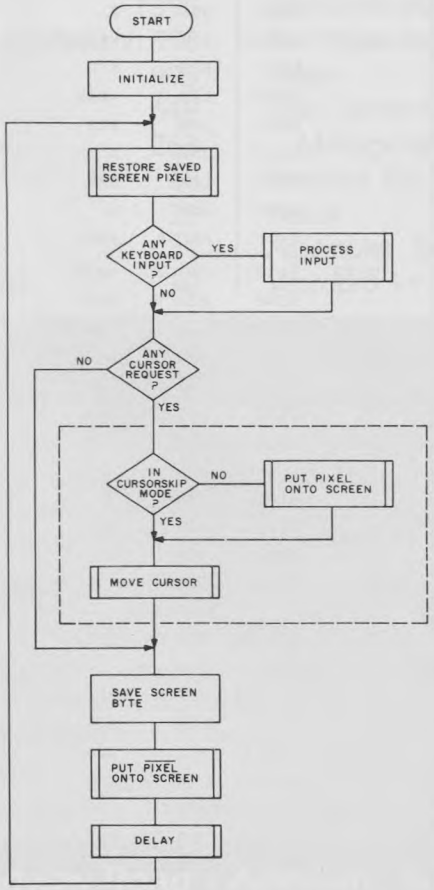

Fig. 3. Overall flowchart.

Program listing in 6800 machine code.

```
0020  0271                          (clear screen
0022  0229                          (string out
0024  FEE1                          (char in - echo back
0026  0285                          (delay
0028  FFA8                          (monitor initialize
002A  0193                          (decode color
002C  01EB                          (get address & mask
002E  02B4                          (process input
0030  0298                          (get byte from screen
0032  0247                          (store pixel on screen
0034  01B8                          (move cursor
0036  02F8                          (store picture
0038  0317                          (load picture
0060  00                            (b/g color
0061  00                            (x-coord
0062  00                            (y-coord
0063  00                            ( -
0064  3FCFF3FC                      (pixel masks
0068  11                            (VDG mode
0069  0000                          ( -
006B  00                            (current color request
006C  00                            (cursor-skip indicator
006D  0380                          (start of picture save area
00A0  4348524F4D412050494345524500  (CHROMA PICTURE
00B8  47524545 4E204F52204255464620534554 00 (GREEN OR BUFF SET
00D0  4241434B47524F554E4420434F4C4F5200  (BACKGROUND COLOR
0100  DE28    LDX    $28            (system initialize
      AD00    JSR    X
      CED069  LDX    =$D069         (put heading onto screen
      DF10    STX    $10
      86A0    LDA A  =$A0
      DE22    LDX    $22
      AD00    JSR    X
010F  CED0A0  LDX    =$D0A0         (ask for color set
      DF10    STX    $10
      86B8    LDA A  =$B8
      DE22    LDX    $22
      AD00    JSR    X
      DE24    LDX    $24            (get and decode answer
      AD00    JSR    X
      8401    AND A  =$01
0120  8A10    OR  A  =$10
      9768    STA A  $68
      CED0E0  LDX    =$D0E0         (ask for background color
      DF10    STX    $10
      86D0    LDA A  =$D0
      DE22    LDX    $22
      AD00    JSR    X
012F  DE24    LDX    $24            (get and decode answer
      AD00    JSR    X
      DE2A    LDX    $2A
      AD00    JSR    X
      9760    STA A  $60
      4F      CLR A                 (put program into graphics mode
      B7F441  STA A  $F441
      43      COM A
013E  B7F442  STA A  $F442
      9668    LDA A  $68
      B7F443  STA A  $F443
      DE20    LDX    $20            (clear graphics screen
      AD00    JSR    X
      9763    STA A  $63            (save screen byte
      4F      CLR A                 (home cursor
      9761    STA A  $61
014F  9762    STA A  $62
```

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Program continued

```
0151  9663    LDA A   $63          (restore byte onto screen
      DE32    LDX     $32
      AD00    JSR     X
      01      NOP
      01      NOP
      01      NOP
      01      NOP
      01      NOP
      01      NOP
      B6F404  LDA A   $F404        (get keyboard input
0160  2B04    BMI     *+4
      DE2E    LDX     $2E          (process input
      AD00    JSR     X
      B6F406  LDA A   $F406        (cursor request?
      841F    AND A   =$1F
      2714    BEQ     *+20
      36      PSH A                (save cursor request on stack
      966C    LDA A   $6C
0170  2606    BNE     *+6
      966B    LDA A   $6B
      DE32    LDX     $32          (store pixel on screen
      AD00    JSR     X
      32      PUL A                (get back cursor request
      DE34    LDX     $34
      AD00    JSR     X
      DE30    LDX     $30          (save screen byte
017F  AD00    JSR     X
      9663    LDA A   $63          (store pixel on screen
      43      COM A
      DE32    LDX     $32
      AD00    JSR     X
      8680    LDA A   =$80         (delay
      DE26    LDX     $26
      AD00    JSR     X
018E  20C1    BRA     0151         (loop back

0193  9716    STA A   $16          (store color byte
      8410    AND A   =$10         (isolate bit 4
      47      ASR A                (move down to bit posn 0
      47      ASR A
      47      ASR A
      47      ASR A
      9717    STA A   $17          (store temporarily in 17
      9616    LDA A   $16          (get compliment of bit 0
      43      COM A
01A0  8401    AND A   =$01
      48      ASL A                (move up to bit posn 1
      9A17    OR  A   $17          (combine with earlier bit
      9717    STA A   $17          (store pixel code in 17
      48      ASL A
      48      ASL A
      9A17    OR  A   $17          (make two pixels
      9717    STA A   $17
      48      ASL A
      48      ASL A
      48      ASL A
01B0  48      ASL A
      9A17    OR  A   $17          (make four pixels
01B3  39      RTS
01B8  D662    LDA B   $62          (y-coord
      46      ROR A
      2403    BCC     *+3
      5A      DEC B                (↑
      2004    BRA     *+4
01C0  46      ROR A
      2407    BCC     *+7
      5C      INC B                (↓
```

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Program continued

```
            C43F    AND B   =$3F         (wrap around if off screen
            D762    STA B   $62
            201A    BRA     *+26
            D661    LDA B   $61          (x-coord
            46      ROR A
            2403    BCC     *+3
            5A      DEC B                (←
01D0        2004    BRA     *+4
            46      ROR A
            2407    BCC     *+7
            5C      INC B                (→
            C47F    AND B   =$7F         (wrap around if off screen
            D761    STA B   $61
            2008    BRA     *+8
            46      ROR A
            2405    BCC     *+5
            5F      CLR B                ( home
01E0        D761    STA B   $61
            D762    STA B   $62
01E4        39      RTS
01EB        CED000  LDX     =$D000       (screen start
            DF10    STX     $10
01F0        D662    LDA B   $62          (y-coord
            270F    BEQ     *+15
            9611    LDA A   $11          (add 32 to 10,11
            8B20    ADD A   =$20
            9711    STA A   $11
            9610    LDA A   $10
            8900    ADC A   =$00         (note any carry
            9710    STA A   $10
0200        5A      DEC B                (do this y-coord times
            26F1    BNE     *-15
            9661    LDA A   $61          (x-coord
            47      ASR A                (divide by 4
            47      ASR A
            9B11    ADD A   $11          (add to 10,11
            9711    STA A   $11
            9610    LDA A   $10
            8900    ADC A   =$00         (not any carry
020F        9710    STA A   $10
            9661    LDA A   $61          (mask address is found by
            8403    AND A   =$03         (checking x-coord bits 0,1
            8B64    ADD A   =$64         (mask table starts at 64
            9713    STA A   $13          (store mask address in 13
            4F      CLR A
            9712    STA A   $12          (actual mask into 13
            DE12    LDX     $12
            A600    LDA A   X
0220        9713    STA A   $13
0222        39      RTS
0229        9717    STA A   $17          (string start into 16,17
            4F      CLR A
            9716    STA A   $16
            DE16    LDX     $16
0230        A600    LDA A   X            (get next string ch
            270C    BEQ     *+12
            08      INX
            DF16    STX     $16          (restore updated string ptr
            DE10    LDX     $10          (get screen byte address
            A700    STA     X            (store ch on screen
            08      INX
            DF10    STX     $10          (update screen ptr
            20EE    BRA     *-17
0240        39      RTS
0247        9719    STA A   $19          (save pixel byte
```

More →

Program continued

```
        DE30    LDX     $30
        AD00    JSR     X               (get screen byte,address and mask
        9663    LDA A   $63
        01      NOP
0250    01      NOP
        9413    AND A   $13             (remove pixel
        9714    STA A   $14
        9613    LDA A   $13
        43      COM A
        9419    AND A   $19             (isolate pixel to be stored
        9A14    OR  A   $14             (put into byte
        0F      SEI                     (stop peripheral ints
        F6F406  LDA B   $F406           (wait until horiz sync
0260    2AFB    BPL     *-4
        F6F406  LDA B   $F406
        2BFB    BMI     *-4
        A700    STA A   X               (store byte on screen
        0E      CLI                     (allow interrupts
026A    39      RTS
0271    9660    LDA A   $60             (background four pixels
        CED000  LDX     =$D0000         (screen start
        A700    STA A   X
        08      INX
        8CD800  CPX     =$D800          (end of screen?
        26F8    BNE     *-12
027E    39      RTS
0285    4A      DEC A                   (millisecond count
        270B    BEQ     *+11
        8D02    BSR     *+2
        20F9    BRA     *-6
        37      PSH B                   (main 1 milli loop
        C68F    LDA A   =$8F
        5A      DEC B
0290    26FD    BNE     *-3
        33      PUL B
0293    39      RTS

0298    DE2C    LDX     $2C             (get screen address & mask
        AD00    JSR     X
        DE10    LDX     $10
        0F      SEI                     (interrupts off
029F    B6F406  LDA A   $F406
        2AFB    BPL     *-5
        B6F406  LDA A   $F406
        2BFB    BMI     *-5
        A600    LDA A   X               (load screen byte
        9763    STA A   $63
        0E      CLI                     (allow interrupts
02AE    39      RTS

02B4    8143    CMP A   =$43            ("C"  cursor-skip
        2604    BNE     *+4
        976C    STA A   $6C
        2035    BRA     *+53
        8151    CMP A   =$51            ("Q"  quit this picture
        2608    BNE     *+8
02C0    86BF    LDA A   =$BF
        B7F441  STA A   $F441
        7E0100  JMP     $0100
        811B    CMP A   =$1B            ("Esc"  back to monitor
        2608    BNE     *+8
        86BF    LDA A   =$BF
02CE    B7F441  STA A   $F441
        7EFAD7  JMP     $FAD7
        8153    CMP A   =$53            ("S"  save picture
        2606    BNE     *+6
        DE36    LDX     $36
        AD00    JSR     X
```

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Program continued

```
          2013   BRA     *+19
          814C   CMP A   =$4C          ("L"  load picture
02E0      2606   BNE     *+6
          DE38   LDX     $38
          AD00   JSR     X
          2009   BRA     *+9
          5F     CLR B                (must be color request
          D76C   STA B   $6C          (clear cursor-skip
          DE2A   LDX     $2A
          AD00   JSR     X
02EF      976B   STA A   $6B          (store current color
02F1      39     RTS
02F8      CED000 LDX     =$D000       (screen start
          DF10   STX     $10
          DE6D   LDX     $6D          (save area start
02FF      DF12   STX     $12
          DE10   LDX     $10          (get next screen byte
          8CD800 CPX     =$D800       (end of screen?
          270E   BEQ     *+14
          A600   LDA A   X
          08     INX
          DF10   STX     $10
          DE12   LDX     $12
030F      A700   STA A   X
          08     INX
          DF12   STX     $12
          20EB   BRA     *-20
0316      39     RTS
0317      CED000 LDX     =$D000       (screen start
          DF10   STX     $10
          DE6D   LDX     $6D          (save area start
          DF12   STX     $12
0320      DE12   LDX     $12          (get saved byte
          A600   LDA A   X
          08     INX
          DF12   STX     $12
          DE10   LDX     $10
          A700   STA A   X            (put byte onto screen
          08     INX
          DF10   STX     $10
 032E     8CD800 CPX     =$D800       (end of screen?
          2DED   BLT     *-18
0333      39     RTS
```

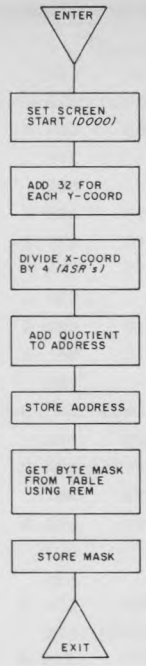

Fig. 5. Converting (x,y) to address and mask.

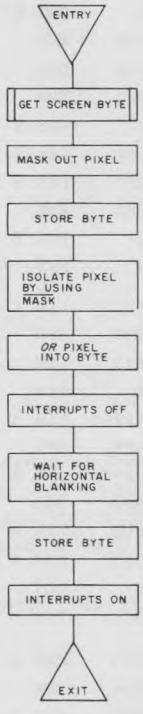

Fig. 6. Store pixel on screen.

placing the pixel into the byte and then storing the byte. Both accesses to memory have to wait for the screen horizontal-blanking period. Unless this is done, flecking occurs on the screen. Note that the call to the load-pixel subroutine has the effect of also loading addresses 0010,0011 with the screen byte address, and location 0013 with the pixel mask.

The clear the screen, 0271 through 027E, performs the task of placing the background color byte into all 2K screen-memory-mapped locations. You need not worry about waiting for the horizontal-blanking period in this subroutine.

0285 through 0293 contains the delay subroutine, which causes a 1 ms delay for the number of times specified in accumulator A.

0298 through 02AE is a simple subroutine that gets the screen-address byte, waits for the horizontal-blanking period and then loads the byte.

The input-decode subroutine is at 02B4 through 02F1, and is described by the flowchart in Fig. 7. Note that only the special commands and the pseudo-color command are specifically tested for; any other input is assumed to be a color request and decoded accordingly. This subroutine is really a subcontrol routine, delegating input processing work to other subroutines.

The save-picture subroutine, 02F8 through 0316, is merely one loop that copies 2K from screen memory to another 2K block of memory.

0317 through 0333 performs the reverse operation of that in the save-picture subroutine. Note that there is no need to wait for horizontal synchronization in these two subroutines.

Program Operation

This program is not meant to be a

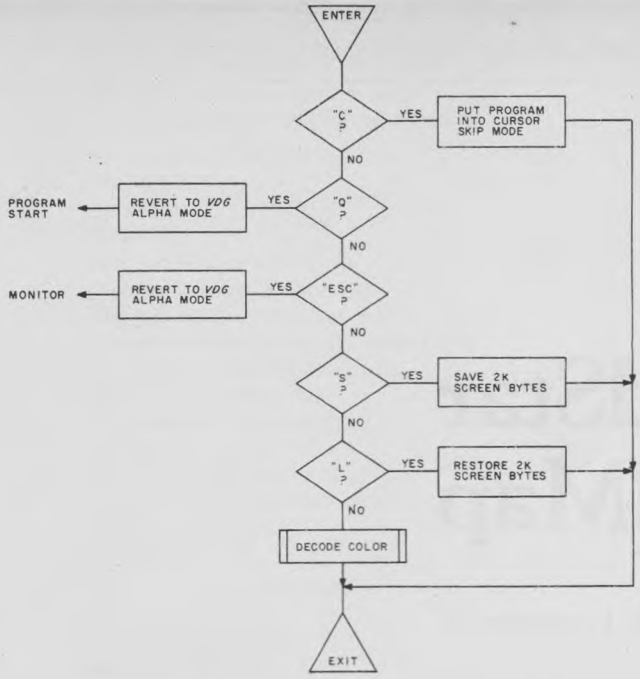

Fig. 7. Process input.

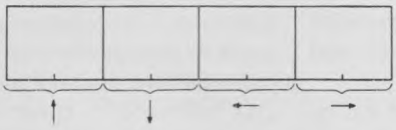

Fig. 8. Joystick byte coding.

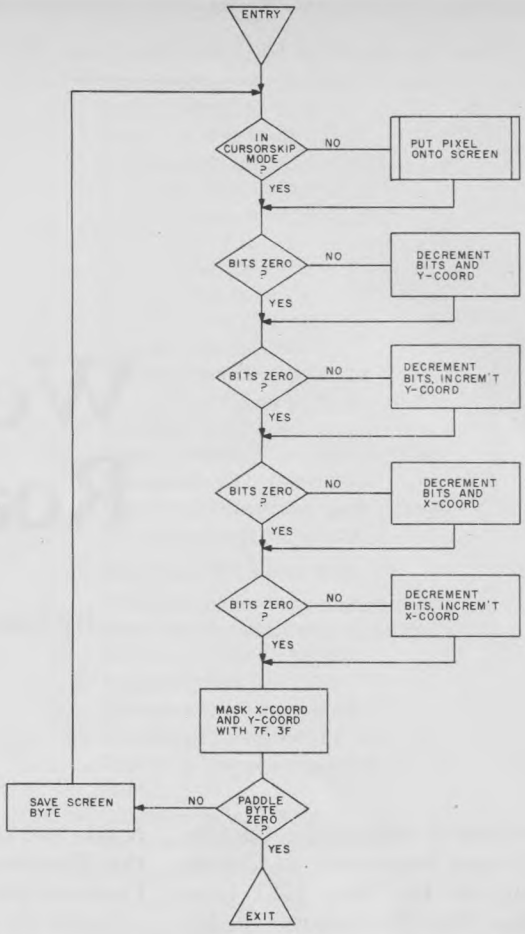

Fig. 9. Modified move cursor for paddle.

model of 6800 coding. In fact, it was our first program in 6800 machine code. It does, however, represent an interesting and colorful application for the TVBUG.

Once we got the basic program working, we found that it responded to the cursor-control keys with somewhat more enthusiasm than was really required. Thus we put in a delay subroutine and found that a delay of about 128 ms was about right. In the first instance we tried to use a flashing cursor by introducing two delays, one after restoring the pixel to the screen, the other after putting the pixel on the screen. However, we found the flashing cursor rather disconcerting and hence replaced the initial delay coding with no ops. If you wish to experiment with a flashing cursor, then apply the patches in Table 3.

We were disappointed with the color clarity of vertical lines, even at this reasonably low resolution. But it appears that this problem is due to the limited bandwidth of the color TV used, rather than TVBUG. A single vertical line is mostly a muddy indistinct color, but horizontal lines are quite clear and very acceptable. The best approximation to the four colors that we could get with a vertical line was with a yellow background in the green color set. To get true colors in vertical lines, we needed to draw three lines together.

Although the program as it stands performs adequately, it is difficult to draw inclined or curved lines. This could be solved by implementing a joystick onto the system. Then, rather than use the cursor-control keypad to draw lines, pictures could be drawn by moving the joystick. The 360-degree movement would allow inclines and curves under easy user control.

Address	Byte
0157	86
0158	50
0159	DE
015A	26
015B	AD
015C	00
0189	50

Table 3.

The joystick input byte could possibly be coded as in Fig. 8, giving an increment value in the range 0 through 3 for each of the four directions currently used on the cursor-control keypad. Then the dotted box in Fig. 3 could be replaced by a call to a modified cursor-control movement routine, as in Fig. 9. Thus with a certain amount of hardware modification, the program would be somewhat easier to use.

In the same vein, the use of the GRYB keys on the keyboard is fine when in the green color set, but somewhat meaningless in the buff set. What would be better would be a separate pad with a four-key set with bisected tops, colored green and buff, red and orange, etc. One could imagine the final artist's electric "palette" being completely separated from the keyboard, and connected to the computer via a lead. The palette would contain color keys, control keys and a joystick, or perhaps our electric artist would even be equipped with a paintbrush in which a light pen was concealed. Eat your heart out, Van Gogh!■

Here's a shortcut that can save you traveling time with the "Cadillac of word processors."

WordStar RoadMap

By Charles R. Perelman

WordStar is indeed the Cadillac of word processors, as Charles Platt says in the May 1981 issue ("Hot Rod Word Processors," p. 40). But the manual, though extensive and informative, has one serious lack: no index.

I've used WordStar for many applications, including a book exceeding 100 pages, and a quick reference guide is an absolute necessity. The index provided here saves me the frustration of calling various menus, and often still not finding the information I want. I've included the Mailmerge option.

I've also discovered a few tricks not covered in the manual which will help you get more out of the software. The controls mentioned here are for the TRS-80 Model II, so there may be some variation with other computers.

First, if you want to underline spaces as well as characters, don't use the embedded underline control in the same line, but instead overprint the spaces on the following line.

Second, on 96-character printwheels, you can get additional characters by pressing the control key and the digit 6, 9 or 0 at the same time. The manual does cover the ability to obtain two additional characters with the Phantom Space (control-F) and Phantom Rubout (control-G).

Third, the F1 key sends out a control A and the F2 key a control B. You may find it quicker to move the cursor back one word with the F1 key and to reform paragraphs with the F2 key, rather than use two separate key strokes.

Fourth, to reformat an entire document—as, for example, when you want to change the margins throughout—use the repeat function: control QQ, followed by control-B or F1 and number 1 for the fastest speed. You must be sure that Hyphen-help is off.

The index and these hints should significantly speed up your use of this fine word processing software, and reduce the training time for new users.■

Address correspondence to Charles R. Perelman, A Professional Corporation, 9777 Wilshire Blvd., Suite 700, Beverly Hills, CA 90212.

Index to WordStar

This school district traded in its no. 2 lead pencils for PET computers to administer competency exams.

Put to the Test By a Computer

By Leonard T. Meuer

High school students in the Travis, CA, Unified School District must pass a series of competency exams to graduate. Formerly, we used a standard and familiar system: students were given booklets, and blacked the appropriate spaces on corresponding answer sheets. But while the scoring agency was able to handle the scoring of the major categories—reading, writing and math—it was unable to score the subcategories without extensive reprogramming and cost. So we decided to switch to an alternative system, using three Commodore PETs.

The new alternative system uses the same general instructions and questions as the paper-and-pencil exams. A student sits down at the microcomputer and the exam is started by a staff member. Instructions are presented on a cleared video display. The student types in his or her name and number, and the questions are presented one at a time.

The student presses a 1, 2, 3, 4 or 5 for his choice. Since wrong answers are not counted against the student, he is encouraged and must respond to go on to the next question. Upon pressing the number of his choice the next question is presented.

The computer will only respond when 1, 2, 3, 4 or 5 is pressed. After completing all questions a student is thanked by the computer and instructed to report to his normal assigned place, and told that he will later be contacted by his counselor with the results.

All three exams are on one disk, which is write-protected. The program runs on 16K machines. Student responses are automatically recorded on a second disk. Scoring is done by yet another program, for security reasons. One disk will hold the scores for a minimum of 500 students.

A student cannot call up a program without the proper passwords. Immediately upon completion of an exam, it is cleared from the computer. He cannot self-score or list the program, or scan it for the answers. Since all programs of the system are disk-based, security is tightened by placing the disk in a locked metal file along with the backup disks.

Conclusions

Students that tried the exams liked it. They felt more motivated even though the questions were the same as the written version. They felt that the process was much less tedious and time-consuming because of not having to blacken in the silly little squares on the answer sheets, and they didn't have to be concerned with putting their answer in the wrong block, making it black enough or having smudges on the answer sheet.

Since questions are presented only one at a time, a student's concentration doesn't wander to other questions. A student does his or her own work because he or she doesn't have someone else's answer sheet to look at. Visually or physically handicapped students were able to progress through the exams without special attention.

From the prepilot and pilot information gathered we feel that the administering of competency exams by computer is a valid alternative method of administering the exams, and that it provides a method of meeting special needs. The scoring programs used provide the necessary information without superfluous markings on the answer scoring sheets. Standard exams can also be scored in the same format by using an answer sheet reader attached to the microcomputer system. Thus, a one-time capital outlay (less than the cost of sent-out scoring) results in considerable dollar and time savings.■

Address correspondence to Leonard T. Meuer, 1790 Burbank Court, Fairfield, CA 94533.

```
AAFW              WRITING                    7-14-81
AAFW                 1
OVER-ALL SCORE =   90.90908   %
TOTAL ELAPSED TIME = 637

 1     FIND INCOMPLETE SENT.    1*
 2     FIND INCOMPLETE SENT.    2*
 3     FIND INCOMPLETE SENT.    3*
 4     FIND INCOMPLETE SENT.    1*
 5     FIND COMPLETE SENT.      2*
 6     FIND COMPLETE SENT.      1*
 7     FIND COMPLETE SENT.      4*
 8     FIND COMPLETE SENT.      2*  100   % ON COMP#   01
 9     END PUNCTUATION          2*
10     END PUNCTUATION          3*
11     END PUNCTUATION          1*
12     END PUNCTUATION          2*
13     SPELLING-E SOUND         2*
14     SPELLING-E SOUND         4*
15     SPELLING-K SOUND         3*
16     SPELLING-PLURAL          1*
17     SPELLING-F SOUND         1*
18     SPELLING-PLURAL          2*
19     SPELLING-ADD LY          4*
20     SPELLING-COMPOUNDS       3*
21     SPELLING-ADD ING         1*
22     SPELLING-ADD ING         2*
23     SPELLING-ADD ITY         1*
24     SPELLING-ADD ED/ING      2
25     SUBJECT-VERB AGREEMENT   2*
26     SUBJECT-VERB AGREEMENT   2*
27     SUBJECT-VERB AGREEMENT   1*
28     SUBJECT-VERB AGREEMENT   1*
29     SUBJECT-VERB AGREEMENT   3*
30     SUBJECT-VERB AGREEMENT   3*
31     SUBJECT-VERB AGREEMENT   1
32     SUBJECT-VERB AGREEMENT   4*
33     WORD CAPITALIZATION      4*
34     WORD CAPITALIZATION      3*
35     WORD CAPITALIZATION      2*
36     WORD CAPITALIZATION      1*
37     PUNCTUATION-COMMAS       1*
38     PUNCTUATION-COMMAS       4*
39     PUNCTUATION-COMMAS       4*
40     PUNCTUATION-COMMAS       1*
41     APOSTROPHES-CONTRACT     3*
42     APOSTROPHES-CONTRACT     2
43     APOSTROPHES-CONTRACT     2*
44     APOSTROPHES-POSSESS      4  88.8888889  % ON COMP#   02
```

Sample results from the computerized writing competency exam.

↙See List of Advertisers on page 210

When it comes to extending BASIC with assembly-language routines, the former has the advantage.

Compiled vs Interpreted BASIC

By Murray L. Lesser

One of the advantages of using a compiled BASIC is that you can easily extend the language to suit your own needs by using assembly-language subroutines. Such language extensions operate like built-in functions: you call them by name, along with the BASIC variables to be operated upon.

As an example of how this works, I'll give two such added functions, along with a pair of system utilities that use them. All examples are written for Microsoft's BASCOM (the compiler version of BASIC-80) running under CP/M, but you can modify them to suit your own system.

The first subroutine, PICKUP, makes a BASIC string variable out of the rest of the CP/M "command line" that was keyed in along with the program call. This lets you pass variable information to the program as part of the original keyed-in calling sequence.

The second function, SCRAM, is a substitute for BASIC's RUN or CHAIN commands. The difference is that SCRAM allows you to specify the complete CP/M command line as a string variable, to be operated on by CP/M's console command processor as if you had keyed in the line. SCRAM is especially useful in chaining to system programs requiring an extensive command sequence.

The two subroutines are written for Microsoft's Macro-80 assembler, to link with BASCOM compilations using the LINK-80 linking loader. I have used Zilog mnemonics to make use of Z-80 instructions not available in the 8080, the most important of which is the block move, LDIR.

If your CPU chip is an 8080 or 8085, you must find another way to perform the non-8080 instructions, such as writing a program loop to substitute for LDIR. You will also have to transliterate into Intel mnemonics if you want the assembler to catch the errors when you try to use instructions that cannot be executed. (For help in the translation, see, for example, Kathe Spracklen's book, *Z-80 and 8080 Assembly Language Programming*.)

Passing Parameter

Before I discuss the subroutines, it might be well to consider the manner in which variables are "passed" between the BASIC program and an assembly-language subroutine.

You have to tell the subroutine where to find the variables it is to use. You do this as part of the CALL statement. Imagine a subroutine, named DOESIT, that expects to get two variables, do something with them and return the result. Suppose the two variables DOESIT does it to are ALPHA and BETA, and the result (which has to have a name so you can use it later in the BASIC program) is GAMMA. All you write in the BASIC program is: CALL DOESIT(ALPHA,BETA, GAMMA).

The subroutine can't read your BASIC program, but Microsoft has a convention for passing parameters. This is given in Microsoft's BASIC-80 (release 5.0) reference manual, Appendix C, but a little review won't hurt.

When the compiler and link-loader do their stuff with the CALL command, the addresses of the variables are passed to the subroutine. These are the same addresses that would be returned to you if you had used the VARPTR function for those variables and stayed in BASIC. On subroutine calls, the addresses are passed in the internal registers of the CPU chip. For three or fewer variables, the address of the first named variable in the calling statement will be in register pair HL, the second in DE and the third in BC. (For more than three variables, you had better study Appendix C very carefully.)

Once the subroutine has these addresses, it has to know—in great detail—what to do with them. There is nobody but you to check for mismatched types and other such syntax errors. You must know what kind of variable to expect, as well as its internal representation, before you can write the subroutine.

What follows will be kept simple. Since I find compiled BASIC adequate for number crunching, I haven't had any need to write subroutines involving floating-point variables (which have the hardest internal representation to understand). So from here on in, we will consider only string variables. For the two subroutines in this article, we will consider only one string variable per subroutine.

For a string variable, the address passed in register pair HL (if there is only one) points to a block of three consecutive bytes in RAM. The number in HL is the address of the first byte, which contains the count (in binary) of the number of characters in the string. The next two bytes of this

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string pointer contain the starting address of the actual string. Thus, the subroutine gets a pointer (address) pointing to a string pointer, which points to the string itself.

Each time BASCOM finds a newly-named string variable during the compilation, it sets up a string pointer in the data segment (DSEG) of the program space. If the string is a *literal* (that is, a string embedded in the program text), the BASCOM compiler will put it in DSEG and enter its location in the string pointer. However, if the string is a variable to be obtained from an INPUT statement, or from operating on other string variables or literals, BASCOM will initialize the string pointer to all zeros.

The first time you execute a command giving a value to that string variable, the actual string will be written in string space—the available RAM not taken up by your program or by BASIC's stack—and the string pointer will be changed to suit. If you change the value of that same-named string variable later in the executed program, the new string will be written somewhere else in string space, and the address in its string pointer will be changed again. Continued reuse keeps filling up string space, leaving garbage (no longer valid strings) laying around in RAM. When things get tight, the BASIC storage manager does a clean-up job to salvage all that abandoned space.

```
                                TITLE   PICKUP

                        ;Written by M. L. Lesser 10-25-80 (rev. 2-28-81)
                        ;Written in Zilog Z80 mnemonics.
                        ;Assembled with Microsoft MACRO-80 release 3.36.

                        ;PICKUP is to be linked with a BASCOM program.  It
                        ;moves the rest of the command line to a string
                        ;literal available to the program.

0000                    BASE    EQU 0000        ;Standard CP?M location
0080                    TBUFF   EQU BASE + 80H

0000'                   PICKUP::                ;Entry point
0000'  36 00                    LD (HL),0       ;Set pointer to zero length
0002'  11 0000"                 LD DE,TEMP      ;Address of string literal
0005'  23                       INC HL          ;Store address of string
0006'  73                       LD (HL),E       ;   in string pointer
0007'  23                       INC HL
0008'  72                       LD (HL),D
0009'  3A 0080                  LD A,(TBUFF)    ;Check string length
000C'  FE 00                    CP 0            ;Is it zero?
000E'  C8                       RET Z           ;If so, return
000F'  06 00                    LD B,0          ;Put string length in BC
0011'  4F                       LD C,A
0012'  11 0080                  LD DE,TBUFF     ;tbuff address in DE
0015'  13               BLANK:  INC DE          ;Skip leading blank
0016'  1A                       LD A,(DE)       ;Check next character
0017'  FE 20                    CP ' '          ;Is it a blank?
0019'  20 04                    JR NZ,MOVE      ;If not, move string
001B'  0D                       DEC C           ;If so, reduce count
001C'  C8                       RET Z           ;Return if zero count
001D'  18 F6                    JR BLANK        ;Else try again
001F'  2B               MOVE:   DEC HL          ;Restore string pointer
0020'  2B                       DEC HL          ;   in HL
0021'  71                       LD (HL),C       ;Store string length
0022'  EB                       EX DE,HL        ;Source address to HL
0023'  11 0000"                 LD DE,TEMP      ;Sink address in DE
0026'  ED B0                    LDIR            ;Block-move string
0028'  C9                       RET

0029'                           DSEG            ;Data space
0000"                   TEMP:   DEFS 128        ;Enough for maximum tbuff
                                END

Symbols:
BASE    0000    BLANK   0015'   MOVE    001F'   PICKUP  0000I'
TBUFF   0080    TEMP    0000"

BASE        11#     12
BLANK       27#     33
MOVE        30      34#
PICKUP      14#
TBUFF       12#     21      26
TEMP        16      38      43#
```

Listing 1. PICKUP subroutine (all examples are written for Microsoft's BASCOM running under CP/M).

The Subroutines

The two subroutines shown here take advantage of the procedure CP/M uses in loading a program. CP/M has a section known as the command control processor (CCP), which is used only for interpreting the initial calls you make on the system from the keyboard. CCP is considered to be expendable by any program. For example, the BASIC storage management routine (that was linked with your program from the system library, BASLIB.REL) starts building the stack down from where CCP ended, and string space up from where your program space ended.

BASIC always knows where to put its stack. The lowest address used by the permanent part of CP/M—the basic disk operating system (BDOS) entry address—can be found in zero-page locations 0006 and 0007. You will have to take my word for this, because if you load in DDT (or any other monitor that writes over CCP)

Listing 2. SCRAM subroutine.

```
                                TITLE SCRAM

                        ;Written by M. L. Lesser, January 17, 1981
                        ;Written in Zilog Z80 mnemonics,
                        ;Assembled with Microsoft MACRO-80 release 3.36

                        ;SCRAM is to be linked with a BASCOM program.
                        ;If SCRAM is used instead of the BASCOM RUN or
                        ;CHAIN commands, it provides a pseudo "auto-load"
                        ;by reloading the CCP and moving the string
                        ;variable into the command buffer.
                        ;Use SCRAM for chaining to system programs that
                        ;require additional parameters.

                        ;WARNING:  ALL FILES OPENED BY THE BASIC PROGRAM
                        ;          MUST BE CLOSED BEFORE CALLING SCRAM

                        ;NOTE:  SCRAM will not operate correctly with a
                        ;       monitor (such as DDT) loaded under BDOS.

0000                    BASE    EQU 0000        ;Standard CP/M location

                        ;Contents of zero-page locations used:
                        ;
0001                    BOOTP   EQU BASE + 01   ;Pointer to WBOOT
0004                    DRIVNO  EQU BASE + 04   ;Default drive number
0005                    BDOS    EQU BASE + 05   ;Jump to BDOS entry
0080                    TBUFF   EQU BASE + 80H  ;Start of temporary buffer

                        ;BDOS function used by SCRAM:
                        ;
```

More →

Listing 2 continued.

```
001A                 LDDMA    EQU 26            ;Set DMA Address

0011                 NSECTS   EQU 17  ;CCP on 16 sectors + 6 bytes!

0000'                SCRAM::                    ;Entry point
                                                ;Build dummy command line
0000'   7E                    LD A,(HL)         ;Put length of string
0001'   32 0000"              LD (DUMCOM),A     ;  in dummy command line
0004'   06 00                 LD B,0            ;Set up BC for block move
0006'   4F                    LD C,A
0007'   23                    INC HL            ;Put string address in DE
0008'   5E                    LD E,(HL)
0009'   23                    INC HL
000A'   56                    LD D,(HL)
000B'   EB                    EX DE,HL          ;String address in HL
000C'   11 0001"              LD DE,DUMCOM+1    ;Destination address in DE
000F'   ED B0                 LDIR              ;Move string to dummy line
0011'                SETUP:
0011'   31 0100               LD SP,TBUFF+80H   ;Use tbuff for stack
0014'   2A 0001               LD HL,(BOOTP)
0017'   16 00                 LD D,0
0019'   1E 15                 LD E,15H          ;Calculate CBIOS "HOME"
001B'   19                    ADD HL,DE         ;   address = WBOOT + 15H
001C'   22 0080"              LD (HOMEP),HL     ;Pointer to HOME jump entry

001F'   1E 03                 LD E,3            ;Calculate CBIOS "SELDSK"
0021'   19                    ADD HL,DE         ;  = HOME + 03
0022'   22 0082"              LD (DISKP),HL     ;Pointer to SELDSK entry
0025'   1E 06                 LD E,06           ;CBIOS "SETSEC" jump
0027'   19                    ADD HL,DE         ;  = SELDSK + 06
0028'   22 0084"              LD (SECP),HL      ;Load pointer to entry
002B'   19                    ADD HL,DE         ;READ = SETSEC + 06
002C'   22 0086"              LD (READP),HL
002F'   2A 0006               LD HL,(BDOS+1)    ;Jump address to BDOS
0032'   11 F7FA               LD DE,0F7FAH      ;CCP entry =
0035'   19                    ADD HL,DE         ;    BDOS entry - 806H
0036'   22 0088"              LD (CPMBP),HL     ;Pointer to CCP entry
0039'   0E 00                 LD C,0
003B'   2A 0082"              LD HL,(DISKP)
003E'   CD 0099'              CALL CBIOS        ;Select Disk A
0041'   2A 0080"              LD HL,(HOMEP)
0044'   CD 0099'              CALL CBIOS        ;Select track 0
0047'   ED 5B 0088"           LD DE,(CPMBP)     ;Initial DMA address
004B'   06 11                 LD B,NSECTS
004D'   0E 02                 LD C,2            ;First sector to read
004F'                LOAD:                      ;Pseudo warm start
004F'   D5                    PUSH DE           ;Save DMA address
0050'   C5                    PUSH BC           ;Save sector data
0051'   0E 1A                 LD C,LDDMA
0053'   CD 0005               CALL BDOS         ;Set DMA address
0056'   C1                    POP BC            ;Recall sector data
0057'   C5                    PUSH BC           ;Save it for later
0058'   2A 0084"              LD HL,(SECP)
005B'   CD 0099'              CALL CBIOS        ;Set next sector
005E'   2A 0086"              LD HL,(READP)
0061'   CD 0099'              CALL CBIOS        ;Read it in
0064'   FE 00                 CP 0
0066'   20 A9                 JR NZ,SETUP       ;If error, try again
0068'   C1                    POP BC            ;Recall old sector data
0069'   05                    DEC B             ;DEC sector count
006A'   28 09                 JR Z,FINISH
006C'   0C                    INC C             ;Next sector
006D'   D1                    POP DE            ;Recall old DMA address
006E'   21 0080               LD HL,80H
0071'   19                    ADD HL,DE
0072'   EB                    EX DE,HL          ;Next DMA address
0073'   18 DA                 JR LOAD
0075'                FINISH:
0075'   2A 0088"              LD HL,(CPMBP)     ;Calculate CCP auto-load
0078'   11 0007               LD DE,7           ;  entry = CPMB + 7
007B'   19                    ADD HL,DE
007C'   11 0000"              LD DE,DUMCOM      ;Image of Command Line
007F'   EB                    EX DE,HL          ;Set up for move
0080'   7E                    LD A,(HL)
0081'   3C                    INC A             ;Must move 'length' + 1
0082'   06 00                 LD B,0
0084'   4F                    LD C,A
0085'   ED B0                 LDIR              ;Move DUMCOM to Command Line
0087'   3E 00                 LD A,0
0089'   12                    LD (DE),A         ;Add null to Command Line

008A'   11 0080               LD DE,TBUFF
008D'   0E 1A                 LD C,LDDMA
008F'   CD 0005               CALL BDOS         ;Reset DMA address to tbuff
0092'   3A 0004               LD A,(DRIVNO)     ;Restore logged-on disk
0095'   4F                    LD C,A
0096'   2A 0088"              LD HL,(CPMBP)     ;Jump to CCP entry
0099'   E9           CBIOS:   JP (HL)
                     ;
                     ;
009A'                         DSEG              ;Data Space
0000"                DUMCOM:  DEFS 128          ;Image of Command Line
                     ;
                     ;Pointers to CBIOS jump table:
                     ;
0080"   0000         HOMEP:   DEFW 0            ;to "HOME"
0082"   0000         DISKP:   DEFW 0            ;to "SELDSK"
0084"   0000         SECP:    DEFW 0            ;to "SETSEC"
0086"   0000         READP:   DEFW 0            ;to "READ"
                     ;
                     ;Pointer to CCP entry (CPMB):
                     ;
```

More →

to look at those locations, the monitor will change the pointer in them to *its* lowest permanent address.

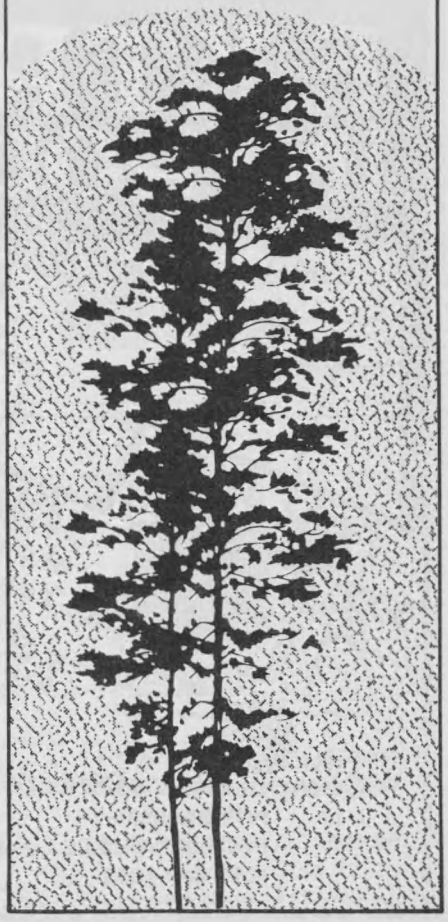
Anything you type in after the system prompt goes to the CCP command buffer. This is the same buffer that would carry a prerecorded command on boot if you were using CP/M's auto-load feature. (See "For CP/M: Automatic Program Execution on Start-Up," by Jon Lindsay, *Microcomputing*, January 1981, p. 184.) When you type in the carriage return, CCP goes to work.

CCP considers everything in the command buffer ahead of the first blank to be the name of the program called. So it tries to load a ".COM" file with that same name into the "transient program area." If it finds the program and loads it, CCP puts the rest of the command line into CP/M's "temporary buffer" (tbuff), which starts at 0080H. The first byte in tbuff is the number (in binary) of valid characters moved. This is followed by the text, including that first blank. When CCP is done, it transfers control to the start of the program you just called. (For additional details, see the Digital Research manual, *CP/M Interface Guide*.)

PICKUP (Listing 1) makes a BASIC string literal out of that "rest of the command line" after stripping off the leading blank(s). It moves the remaining valid characters to a location within the subroutine itself and changes the string pointer to fit. If there was nothing in the command line after the program name, PICKUP will return a zero-length string to BASIC. As written, the subroutine assumes a standard CP/M with the zero-page origin at address 0000. If your CP/M has a zero-page offset, use that address for the value of BASE given in line 11.

You will notice two PICKUPs in the listing. The first, with the pseudo-op "TITLE," is the name of the module. The Microsoft library manager utility, LIB-80, works with module names. The second PICKUP, the label with the two colons in line 14, is the entry point to the subroutine. The CALLs from BASIC programs are to entry labels. If any module has more than one entry point, you CALL whichever entry label is pertinent. I usually keep the module name and the main entry point name the same, to avoid confusing myself.

Unlike most programs running under CP/M, SCRAM (Listing 2) by-



Listing 2 continued.

```
 132     0088"   0000                    CPMBP:  DEFW 0
 133                                     ;
 134                                             END

Symbols:
BASE    0000    BDOS    0005    BOOTP   0001    CBIOS   0099'
CPMBP   0088"   DISKP   0082"   DRIVNO  0004    DUMCOM  0000"
FINISH  0075'   HOMEP   0080"   LDDMA   001A    LOAD    004F'
NSECTS  0011    READP   0086"   SCRAM   0000I'  SECP    0084"
SETUP   0011'   TBUFF   0080

BASE      21#     25      26      27      28
BDOS      27#     64      80      113
BOOTP     25#     51
CBIOS     70      72      84      86      117#
CPMBP     67      73      99      116     132#
DISKP     58      69      126#
DRIVNO    26#     114
DUMCOM    39      47      102     121#
FINISH    91      98#
HOMEP     55      71      125#
LDDMA     32#     79      112
LOAD      76#     97
NSECTS    34#     74
READP     63      85      128#
SCRAM     36#
SECP      61      83      127#
SETUP     49#     88
TBUFF     28#     50      111
```

Listing 3. LINK utility.

```
00100 '                 ****************
00110 '                 ***   LINK   ***
00120 '                 ****************
00130 '
```

More →

passes Digital Research's portion of the operating system, BDOS, to call directly on the facilities of the hardware-dependent Customized Basic I/O System (CBIOS).

BDOS communicates with the specific hardware making up your system by using a series of jump commands located in the CBIOS jump table. The Digital Research manual, *CP/M System Alteration Guide*, gives the relative location of each entry in the table and the action CBIOS must take for each call. The absolute address of one of the entries, WBOOT, is stored in zero-page locations 0001 and 0002.

SCRAM uses this information to build a set of pointers to the CBIOS functions it needs. It calculates the starting address of CCP by subtracting 0806H from the BDOS entry-point address. SCRAM then overlays BASIC's stack and upper string space by reloading CCP from the A disk, moves the string variable that is to become the command line into the CCP command buffer, and finishes by passing control to the CCP entry point. CP/M then takes over, fooled into thinking

it has just received a warm boot from a disk with an auto-load message.

Strictly speaking, SCRAM is not a subroutine; it doesn't have a return to the calling program. However, BASIC doesn't know this, so SCRAM is called with the usual subroutine CALL.

Since it makes use of CP/M's internal structure, SCRAM probably cannot be used, unmodified, with any other operating system—not even those claimed to be "compatible" with CP/M. Although it is written to be independent of the memory size of your system and the initial address of your CCP, it does make use of known locations in the zero page. If your version of CP/M has a zero-page offset, change the value of BASE in line 21.

The Utilities

Utility programs are supposed to make life easier for the programmer. That is why I wrote the two shown here.

Debugging can be one of the most frustrating activities known to mankind. Late one night, after the third recompilation and relink in 15 minutes, I began to make operator errors

Listing 3 continued.

```
00140   '       Written by M. L. Lesser, January 17, 1981
00150   '       Written in Microsoft BASIC-80 version 5.2
00160   '       Compiled with BASCOM 5.2, switch /Z
00170   '
00180   '       This program link-loads <filename.REL> produced by
00190   '       the BASCOM BASIC-80 compiler with any called assembly-
00200   '       language subroutines from MYLIB.REL.  Input command
00210   '       is "LINK <dev:filename>" typed on the console.
00220   '       Output is <filename.COM>, and is stored on the drive
00230   '       denoted by "dev:" on the calling command line.
00240   '       To "Load and Go", use <dev:filename/G> on input;
00250   '       Output <filename.COM> will still be written to disk.
00260   '
00270   '       To use, LINK.COM, L80.COM, MYLIB.REL and BASLIB.REL
00280   '       must be on the logged-on drive.  <filename.REL> can
00290   '       be on either drive.
00300   '
00310   '
00400   '       The following are string variables:
00410   '
00420   '               FILENAME        Input <dev:filename>
00430   '               COMMAND         L80 calling sequence
00440   '
00450   '
00500   '       Setup
00510   '
00520   DEFINT I
00530   DEFSTR C,F
00540   '
00550   '
01000   '       Main Program
01010   '
01020   CALL PICKUP(FILENAME)                   'Read rest of comand line
01030   IF LEN(FILENAME) = 0 THEN LINE INPUT "<FILENAME>?  ";FILENAME
                ELSE PRINT "Link-loading " FILENAME
01040   LET I = INSTR(FILENAME,"/")             'Check for /G switch
01050   LET COMMAND = "L80 " + FILENAME
01060   IF I = 0 THEN LET COMMAND = COMMAND + "/E,MYLIB/S,"
                  ELSE LET COMMAND = COMMAND + ",MYLIB/S,"
01070   IF I <> 0 THEN LET FILENAME = LEFT$(FILENAME,I-1)
01080   LET COMMAND = COMMAND + FILENAME + "/N"
01090   CALL SCRAM(COMMAND)                     'Link <filename>
01100   '
```


✓See List of Advertisers on page 210

in typing the redundant command line that calls LINK-80. So I wrote LINK (Listing 3) to relieve this added source of frustration.

LINK generates the normal LINK-80 command line, either for "load and save" or "load, save and go," depending on whether you use the switch "/G" after the name of the file that is to be linked. To use LINK, you must put all your private subroutines —including PICKUP and SCRAM—in your private library (MYLIB.REL) by using LIB-80. Then, LINK will make sure that any subroutine called in the program being linked is inserted in its proper place.

EDIT (Listing 4) is a cure for the near-fatal bug in Microsoft's EDIT-80, release 2.0. While you are editing your text file, EDIT-80 is building an index file so it can write your final version back to disk when you exit from the editor. Unfortunately, if the text file is very long and the changes extensive, release 2.0 leaves the now-obsolete index behind. While the newly-edited file is correct as written to disk and the compiler or assembler can use it, EDIT-80 can't re-edit it until you have gotten rid of the old index file.

EDIT looks for an index file and kills it if it exists, before using SCRAM to call in EDIT-80 and the file to be edited.

Now, in spite of all the foregoing, you don't *have* to use a compiled BASIC to use assembly-language subroutines. Most BASICs have a USR command. And the interpreter version of BASIC-80 release 5.x allows the use of the same CALL command as does BASCOM. However, there is a major difference in what you can't do with an interpreter.

You can't use subroutines that look for data keyed in with the program call, because that call was made after you were already in BASIC. So you can't use PICKUP with an interpreter BASIC.

You can use SCRAM, but I'm not sure it is worth the effort. With the interpreter, you have to know exactly where to put the subroutine in absolute address space. You can't let the system take care of the messy details for you.

Each interpreted program that uses assembly-language subroutines must contain the absolute addresses in RAM where it will find each subroutine it uses, along with a command to protect the subroutine space from BASIC's storage manager. When you want to run one of these programs, you have to load the necessary subroutines into their proper places *before* you call the BASIC interpreter. The bookkeeping, alone, is more bother than it is worth!

Compare this with using LINK to build the subroutines into the compiled object program. Once linked, any subroutine called from your library is a permanent part of the program that called it, and will load with no further effort on your part.

The ease of making your own extensions to the language is another good reason to use a compiled form of BASIC for your serious applications. ■

```
00100  '              ****************************
00200  '              ***   EDIT-80 CLEAN UP   ***
00300  '              ****************************
00400  '
00500  '
00600  '       Written in BASIC-80 BASCOM 5.2, switches /Z/X
00700  '       Written by M. L. Lesser, 1-25-81
00800  '       Object program filed as EDIT.COM
00900  '
01000  '
01100  '       This program corrects for the bug in EDIT-80 release 2.0
01200  '       by erasing the corresponding .$xx index file before starting
01300  '       a new editing session.
01400  '
01500  '       Input command is: EDIT <FILENAME>.  Output is written
01600  '       to the same drive as <FILENAME>.
01700  '
01800  '       NOTE:  Both EDIT.COM and EDIT80.COM must be on the logged-on
01900  '              drive.  <FILENAME> must specify the disk as part of
02000  '              the command line, if not on the logged-on drive.
02100  '
02200  DEFINT I,J
02300  DEFSTR C,F
02400  ON ERROR GOTO 10000
02500  '
02600  CALL PICKUP(FILENAME)                    'Read rest of command line
02700  IF LEN(FILENAME) = 0 THEN GOTO 3300      'If no <filename> call SCRAM
02800  LET I = INSTR(FILENAME,".")              'Check for filetype
02900  LET J = INSTR(FILENAME,"/")              'Check for switch
03000  IF I = 0 THEN GOSUB 5000                 'Insert ".MAC" if no filetype
03100  IF J = 0 OR J - I > 2 THEN LET FILEINDEX = LEFT$(FILENAME,I) +
           "$" + MID$(FILENAME,I+1,2) ELSE GOSUB 7000
                                                 'Short filetype with switch
03200  KILL FILEINDEX                           'Error if no index file
03300  LET COMMAND = "EDIT80 " + FILENAME
03400  CALL SCRAM(COMMAND)                       'Edit <filename>
03500  '
05000  '       Subroutine:  Insert default filetype ".MAC"
05100  IF J = 0 THEN LET FILENAME = FILENAME + ".MAC"
05200  IF J <> 0 THEN LET FILENAME = LEFT$(FILENAME,J-1) + ".MAC" +
           MID$(FILENAME,J)
05300  LET I = INSTR(FILENAME,".")
05400  LET J = INSTR(FILENAME,"/")
05500  RETURN
05600  '
07000  '       Subroutine:  For short filetype when switch exists
07100  LET ITEM = J - I - 1
07200  LET FILEINDEX = LEFT$(FILENAME,I) + "$" + MID$(FILENAME,I+1,ITEM)
07300  RETURN
07400  '
10000  '       Error trap
10100  IF ERR = 53 AND ERL = 3200 THEN RESUME NEXT
10200  ON ERROR GOTO 0
10300  '
```

Listing 4. EDIT-80 utility.

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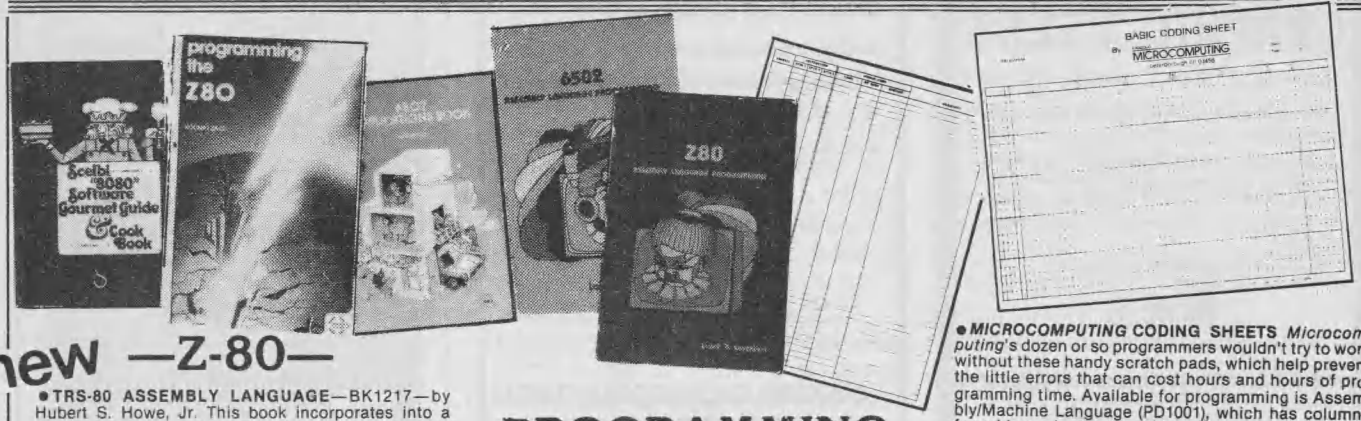

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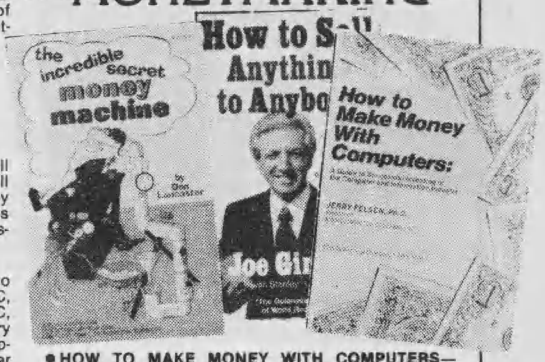

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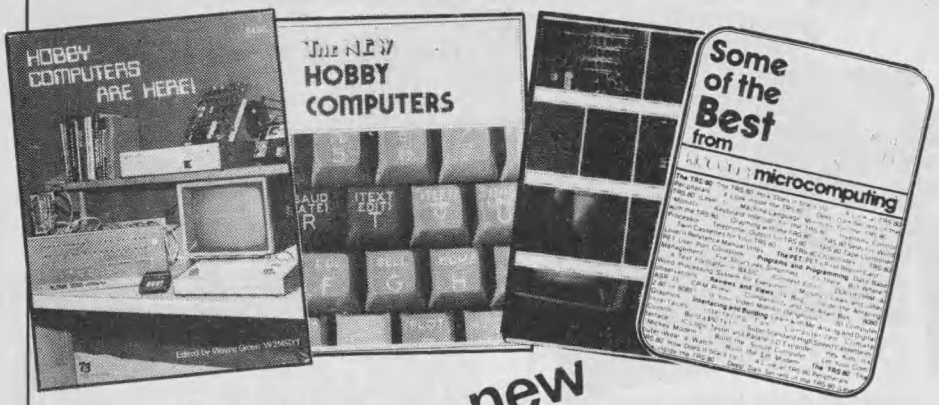

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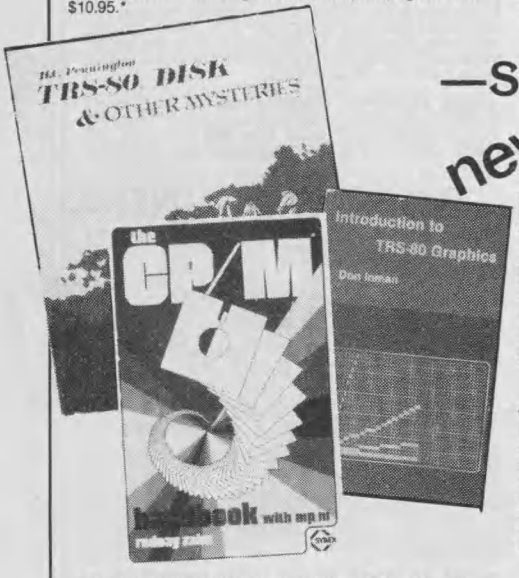

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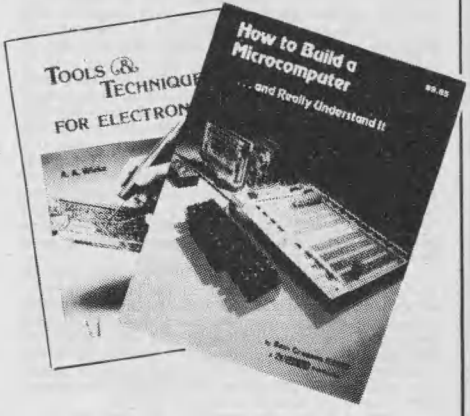

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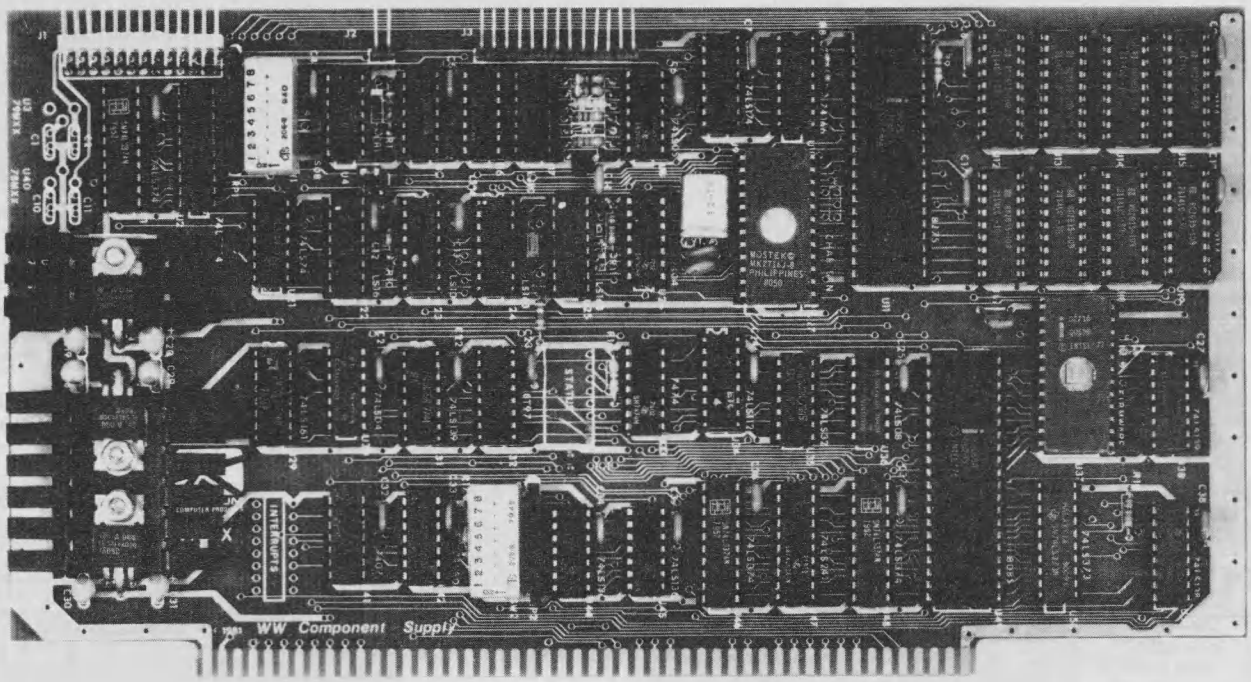

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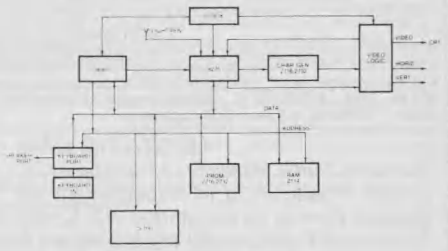

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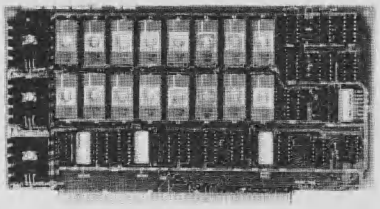

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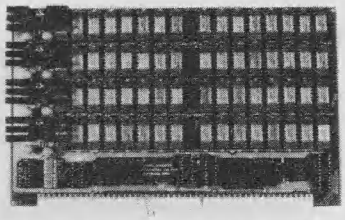

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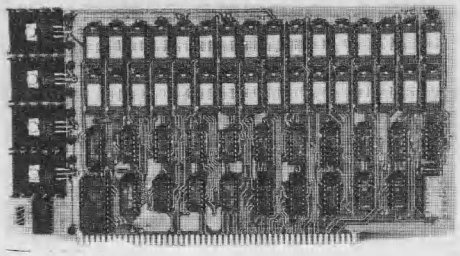

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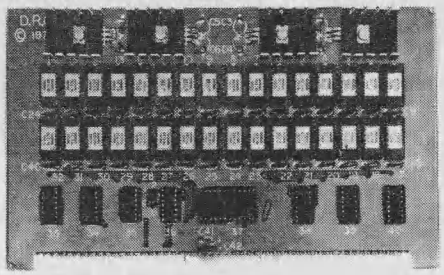

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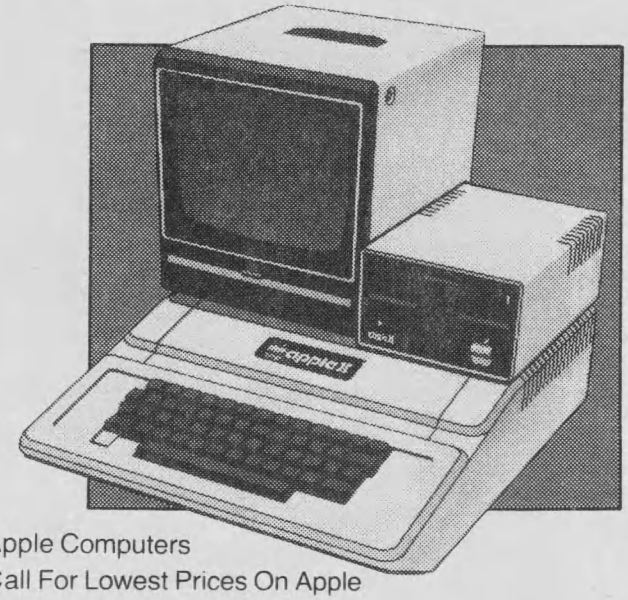

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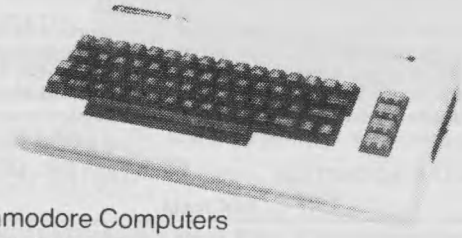

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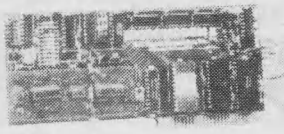

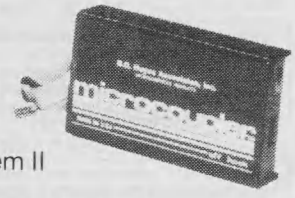

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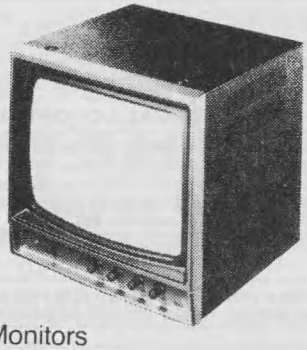

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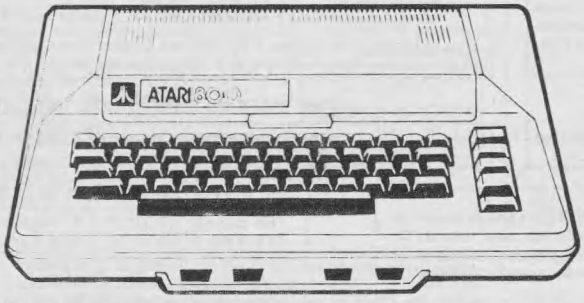

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	Soft Sector (1024 B/S, 8 Sectors)	3104	3.09	473473	54485	800819	1669045	–	–	743-0/1024	–	15102	DD34-4008	F147111X	425622
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	Burroughs B-80 Compatible, 32 Hard Sector	3092	3.09	–	–	–	–	–	–	–	–	–	–	F34A611X	–
	Soft Sector (1024 B/S, 8 Sectors) w/ Hub Ring	3116	3.49	–	–	–	–	–	–	–	–	–	–	–	–
	Shugart Compatible, 32 Hard Sector	3181	3.39	–	–	–	–	–	–	–	–	–	DD32-4000	–	–
Flexible Disc FD															
Memorex 651 or Equiv Drive Compatible	FD VI (Vinyl Jacket)	30712003	2.69	470651	–	FDIV	–	–	FD-165	511-0	–	15026	FD65-1000	F61A111X	–
Mini Flexible Disc 1s	Soft Sector (Unformatted)	3401	1.94	475001	54256	104/1	–	MD1	MD 1	744-0	S/A-104	15300	MD525-01	M11A211X	441002
5¼" Single-Headed Drives	10 Hard Sector	3403	1.94	475016	54257	107/1	–	–	MD 110	744-10	S/A-107	15325	MD525-10	M41A211X	441102
Single-Density Media	16 Hard Sector	3405	1.94	475016	54258	105/1	–	MH1	MD 116	744-16	S/A-105	15326	MD525-16	M51A211X	441182
	Soft Sector (Unformatted) w/Hub Ring	3431	2.14	–	–	–	–	–	–	–	–	–	MD525-01	–	–
	10 Hard Sector, w/Hub Ring	3433	2.14	–	–	–	–	–	–	–	–	–	MD525-10	–	–
	16 Hard Sector, w/Hub Ring	3435	2.14	–	–	–	–	–	–	–	–	–	MD525-16	–	–
Mini Flexible Disc 1d	Soft Sector (Unformatted)	3417	2.14	–	54646	104/1D	–	–	–	–	–	–	MD525-01	–	–
5¼" Single-Headed Drives	10 Hard Sector	3418	2.14	–	54649	107/1D	–	–	–	–	–	–	MD525-10	–	–
Double-Density Media	16 Hard Sector	3419	2.14	–	54652	105/1D	–	–	–	–	–	–	MD525-16	–	–
	Soft Sector (Unformatted) w/Hub Ring	3481	2.34	–	–	–	–	–	–	–	–	–	MD525-01	–	–
	10 Hard Sector w/Hub Ring	3483	2.34	–	–	–	–	–	–	–	–	–	MD525-10	–	–
	16 Hard Sector w/Hub Ring	3485	2.34	–	–	–	–	–	–	–	–	–	MD525-16	–	–
Mini Flexible Disc 2d	Soft Sector (Unformatted)	3421	2.59	–	54624	104/2D	–	–	–	–	S/A-154	–	MD550-01	–	–
5¼" Double-Headed Drives	10 Hard Sector	3423	2.59	–	54627	107/2D	–	–	–	–	S/A-157	–	MD550-10	–	–
Double-Density Media	16 Hard Sector	3425	2.59	–	54630	105/2D	–	–	–	–	S/A-155	–	MD550-16	–	–
	Soft Sector (Unformatted) w/Hub Ring	3491	2.79	–	–	–	–	–	–	–	–	–	MD550-01	–	–
	10 Hard Sector w/Hub Ring	3493	2.79	–	–	–	–	–	–	–	–	–	MD550-10	–	–
	16 Hard Sector w/Hub Ring	3495	2.79	–	–	–	–	–	–	–	–	–	MD550-16	–	–

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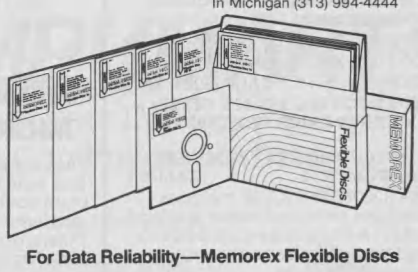

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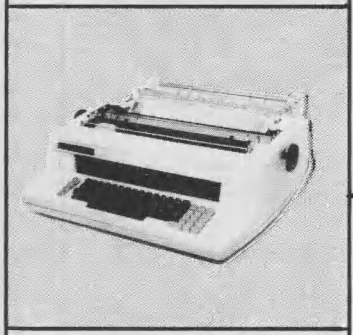

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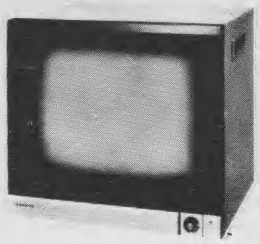

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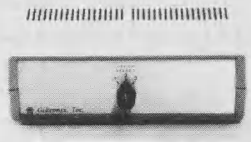

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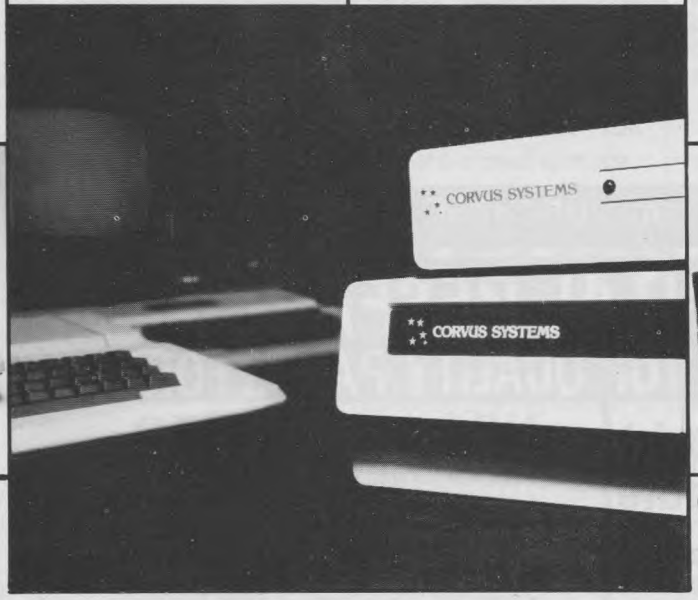

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74LS22	.35	74LS133	.89	74LS253	.99
74LS26	.35	74LS136	.49	74LS257	.89
74LS27	.35	74LS138	.89	74LS258	.69
74LS28	.35	74LS139	.89	74LS260	.69
74LS30	.35	74LS151	.89	74LS266	.69
74LS32	.35	74LS153	.89	74LS273	1.95
74LS33	.59	74LS154	1.75	74LS279	.89
74LS37	.45	74LS155	.89	74LS283	.89
74LS38	.39	74LS156	.89	74LS290	.99
74LS40	.35	74LS157	.89	74LS293	.99
74LS42	.89	74LS158	.89	74LS298	1.25
74LS47	.89	74LS160	1.15	74LS352	1.29
74LS48	1.15	74LS161	1.15	74LS353	1.29
74LS49	1.15	74LS162	1.15	74LS365	.69
74LS51	.35	74LS163	1.15	74LS366	.69
74LS54	.35	74LS164	1.15	74LS367	.69
74LS55	.35	74LS165	1.15	74LS368	.69
74LS73	.45	74LS168	1.19	74LS373	1.95
74LS74	.45	74LS169	1.19	74LS374	1.95
74LS75	.59	74LS170	1.95	74LS375	.89
74LS76	.45	74LS173	.99	74LS386	.69
74LS78	.49	74LS174	.99	74LS393	2.49
74LS83	.89	74LS175	.99	74LS399	2.49
74LS85	1.25	74LS181	2.95	74LS670	2.49
74LS86	.49	74LS190	1.25	81LS95	1.95
74LS90	.69	74LS191	1.25	81LS97	1.95

74S

74S00	.45			74S243	3.25
74S02	.45			74S244	3.25
74S03	.45	74S124	3.95	74S251	1.45
74S04	.55	74S133	.55	74S253	1.45
74S05	.55	74S134	.69	74S257	1.35
74S08	.50	74S135	1.19	74S258	1.35
74S09	.50	74S136	1.75	74S260	.79
74S10	.45	74S138	1.35	74S280	2.95
74S11	.45	74S139	1.35	74S287	3.25
74S15	.45	74S140	.79	74S288	2.75
74S20	.45	74S151	1.35	74S373	3.49
74S22	.45	74S153	1.35	74S374	3.49
74S30	.45	74S157	1.35	74S387	2.95
74S32	.55	74S158	1.35	74S471	10.95
74S38	1.25	74S160	2.95	74S472	10.95
74S40	.50	74S174	1.59	74S473	10.95
74S51	.45	74S175	1.59	74S474	12.95
74S64	.50	74S188	2.95	74S475	12.95
74S65	.50	74S194	1.95	74S570	5.95
74S74	.75	74S195	1.95	74S571	5.95
74S86	.79	74S196	1.95	74S572	9.95
74S112	.79	74S240	2.95	74S573	9.95
74S113	.79	74S241	2.95	74S940	3.15
74S114	.79	74S242	3.25	74S941	3.15

CA–LINEAR

CA3010H	.99			CA3089N	3.75
CA3013H	2.15	CA3060N	3.25	CA3096N	3.95
CA3023H	3.25	CA3080H	1.25	CA3130H	1.39
CA3035H	2.49	CA3081N	2.00	CA3140H	1.25
CA3039H	1.35	CA3082N	2.00	CA3160H	1.25
CA3046N	1.30	CA3083N	1.60	CA3401N	.59
CA3059N	3.25	CA3086N	.85	CA3600N	3.50

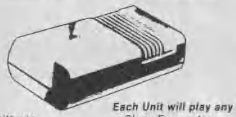
CD–CMOS

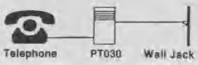
CD4000	.39			CD 4098	2.49
CD4001	.39			CD4506	.75
CD4002	.39			CD4507	.99
CD4006	1.19	CD4041	1.49	CD4508	3.95
CD4007	.25	CD4042	.99	CD4510	1.39
CD4009	.49	CD4043	.89	CD4511	1.29
CD4010	.49	CD4044	.89	CD4512	1.49
CD4011	.39	CD4046	1.79	CD4514	3.95
CD4012	.25	CD4047	2.50	CD4515	2.95
CD4013	.49	CD4048	1.35	CD4516	1.49
CD4014	1.39	CD4049	.49	CD4518	1.79
CD4015	1.19	CD4050	.69	CD4519	.89
CD4016	.59	CD4051	1.19	CD4520	1.29
CD4017	1.19	CD4052	1.19	CD4526	1.79
CD4018	.99	CD4053	1.19	CD4528	1.79
CD4019	.49	CD4056	2.95	CD4529	1.95
CD4020	1.19	CD4059	9.95	CD4543	2.79
CD4021	1.39	CD4060	1.49	CD4562	11.95
CD4022	1.19	CD4066	.79	CD4566	2.79
CD4023	.29	CD4068	.39	CD4583	2.49
CD4024	.79	CD4069	.45	CD4584	.75
CD4025	.23	CD4070	.55	CD4723	1.95
CD4026	2.95	CD4071	.49	CD4724	1.95
CD4027	.69	CD4072	.49	MC14409	17.95
CD4028	.89	CD4073	.39	MC14410	18.95
CD4029	1.49	CD4075	.39	MC14411	15.95
CD4030	.49	CD4076	1.39	MC14412	15.95
CD4034	3.49	CD4078	.55	MC14419	7.95
CD4035	.99	CD4081	.39	MC14433	15.95
CD4040	1.49	CD4082	.39	MC14538	2.49
		CD4093	.99	MC14541	1.95

Phone Tunes

As Seen on "Good Morning America"

Replaces the Telephone Ringer Bell with a Selection of 30 Familiar Tunes





Each Unit will play any of the following tunes:

- Rule Brittania
- O Canada
- Colonel Bogey
- Westminster Chimes
- Mexican Hat Dance
- Twinkle, Twinkle Little Star
- Deutschlandlied
- God Save the Queen
- Close Encounters
- Happy Birthday
- Wedding March
- Jingle Bells
- Auld Lang Syne
- Soldiers Chorus
- Sailor's Hornpipe
- Charge!
- Greensleeves
- Lorelei
- Eyes of Texas
- Star Spangled Banner
- Oranges and Lemons
- Wilhelmus
- Mozart Sonata
- Pomp & Circumstance
- William Tell Overture
- Bach Toccata in D Minor
- Shave and a Haircut
- Blue Danube Waltz
- Beethoven's 5th
- La Marseillaise

FEATURES

Replaces monotonous telephone ringer bell. Easily connects to any standard telephone. Can be used alongside regular phone or replace a remote ringer elsewhere in building or outside. FCC approved. Can be used on any telephone system — worldwide. Use a different tune to identify extension phones. Microprocessor controlled. Adjustable volume control and variable tune speed control. Operates on two 9-volt batteries or AC Adapter (not included).

PT030 Phone Tunes $49.95
AD30 AC Adapter $8.95

DISCRETE LEDS

XC556R	.200"	red	5/$1	MV50	.085"	red	6/$1
XC556G	.200"	green	4/$1	XC209R	.125"	red	5/$1
XC556Y	.200"	yellow	4/$1	XC209G	.125"	green	4/$1
XC556C	.200"	clear	4/$1	XC209Y	.125"	yellow	4/$1
XC22R	.200"	red	5/$1	XC526R	.185"	red	5/$1
XC22G	.200"	green	4/$1	XC526G	.185"	green	4/$1
XC22Y	.200"	yellow	4/$1	XC526Y	.185"	yellow	4/$1
MV10B	.170"	red	4/$1	XC526C	.185"	clear	4/$1

.200(T1¾) Red/Green

Diffused Bi-Color LED

Part No.	1-99	100+
XC5491	.79	.69

XC556 RED LED, METAL MTG. HDW. 2-6" LEADS.

RL-2 . . $.39 ea. or 3/$1.00

DISPLAY LEDS

C.A. — Common Anode
D.D. — Double Digit
C.C. — Common Cathode
RHD — Right Hand Decimal

Type	Polarity	Ht	Price	Type	Polarity	Ht	Price
MAN 1	C.A.—red	.270	2.95	DLG507	C.A.—green	.500	1.25
MAN 2	5x7 D.M.—red	.300	4.95	DL704	C.C.—red	.300	1.25
MAN 3	C.C.—red	.125	.25	DL707	C.A.—red	.300	1.25
MAN 52	C.A.—green	.300	.99	DL728	C.C.—red	.500	1.49
MAN 54	C.C.—green	.300	.99	DL741	C.A.—red	.600	1.25
MAN 71	C.A.—red	.300	.75	DL747	C.A.—red	.600	1.49
MAN 72	C.A.—red	.300	.75	DL750	C.C.—red	.600	1.49
MAN 74	C.C.—red	.300	1.25	DLO847	C.A.—orange	.800	1.49
MAN 82	C.A.—yellow	.300	.49	DLO850	C.C.—orange	.800	1.49
MAN 84	C.C.—yellow	.300	.99	DL33B	C.C.—red	.110	.35
MAN 3620	C.A.—orange	.300	.49	FND358	C.C. ± 1	.357	.99
MAN 3630	C.A.—orange ± 1	.300	.99	FND357	C.C.	.357	.75
MAN 3640	C.C.—orange	.300	.99	FND500	C.C. (FND503)	.500	.99
MAN 4610	C.A.—orange	.400	.99	FND507	C.A. (FND510)	.500	.99
MAN 6610	C.A.—orange—DD	.560	.99	HDSP-3401	C.A.—red	.800	1.50
MAN 6630	C.A.—orange ± 1	.560	.99	HDSP-3403	C.C.—red	.800	1.50
MAN 6640	C.C.—orange—DD	.560	.99	HDSP-3406	C.C. red ±1	.800	1.50
MAN 6650	C.C.—orange ± 1	.560	.99	5082-7751	C.A., R.H.D.—red	.430	1.25
MAN 6660	C.A.—orange	.560	.99	5082-7760	C.C., R.H.D.—red	.430	1.25
MAN 6710	C.A.—red—DD	.560	.99	5082-7300	4x7 Numeric (RHD)	.600	22.00
MAN 6740	C.C.—red—DD	.560	.99	5082-7302	4x7 Numeric (LHD)	.600	22.00
MAN 6750	C.C.—red ± 1	.560	.99	5082-7340	4x7 Hxdcl. (0-9/A-F)	.600	22.50
DLO304	C.C.—orange	.300	1.25	4N28	Photo Xsistor Opto-Isol.		.69
DLO307	C.A.—orange	.300	1.25	LIT-1	Photo Xsistor Opto-Isol.		.69
DLG500	C.C.—green	.500	1.25	MOC3010	Optically Isol. Triac Driver		1.25

SOCKETS — RECEPTACLES

Test TEXTOOL Sockets

ZERO INSERTION FORCE

- Nickel Boron Plating
- G.F. PSF Plastic Body
- For testing IC's

Part No.	Pins	Price	Part No.	Pins	Price
214-3339	14 pin	5.95	222-3343	22 pin	9.95
216-3340	16 pin	6.49	224-3344	24 pin	9.75
218-3341	18 pin	7.95	228-3345	28 pin	11.95
220-3342	20 pin	8.95	240-3346	40 pin	12.95

- Nickel Boron Plating
- G.F. PSF Plastic Body
- Wire Wrap Contacts

Part No.	Pins	Price	Part No.	Pins	Price
214-3592	14 pin	9.75	222-3596	22 pin	12.95
216-3593	16 pin	9.95	224-3597	24 pin	12.75
218-3594	18 pin	10.95	228-3598	28 pin	13.95
220-3595	20 pin	11.95	240-3599	40 pin	15.95

LOW PROFILE (TIN) SOCKETS

	1-24	25-49	50-100
8 pin LP	.17	.16	.15
14 pin LP	.20	.19	.18
16 pin LP	.22	.21	.20
18 pin LP	.29	.28	.27
20 pin LP	.34	.32	.30
22 pin LP	.37	.36	.35
24 pin LP	.38	.37	.36
28 pin LP	.45	.44	.43
36 pin LP	.60	.53	.58
40 pin LP	.63	.62	.61

SOLDERTAIL STANDARD (TIN)

	1-24	25-49	50-100
14 pin ST	.27	.25	.24
16 pin ST	.30	.27	.25
18 pin ST	.35	.32	.30
24 pin ST	.49	.45	.42
28 pin ST	.99	.90	.81
36 pin ST	1.39	1.26	1.15
40 pin ST	1.59	1.45	1.30

SOLDERTAIL (GOLD) STANDARD

	1-24	25-49	50-100
8 pin SG	.39	.35	.31
14 pin SG	.49	.45	.41
16 pin SG	.54	.49	.44
18 pin SG	.59	.53	.48
24 pin SG	.79	.75	.69
28 pin SG	1.10	1.00	.90
36 pin SG	1.65	1.40	1.26
40 pin SG	1.75	1.59	1.45

WIRE WRAP SOCKETS (GOLD) LEVEL #3

	1-24	25-49	50-100
8 pin WW	.59	.54	.49
10 pin WW	.69	.63	.58
14 pin WW	.79	.73	.67
16 pin WW	.85	.77	.70
18 pin WW	.99	.90	.81
20 pin WW	1.19	1.08	.99
22 pin WW	1.49	1.35	1.23
24 pin WW	1.39	1.26	1.14
28 pin WW	1.69	1.53	1.38
36 pin WW	2.19	1.99	1.79
40 pin WW	2.29	2.09	1.89

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ASST. 1	5ea.	10 Ohm 12 Ohm 15 Ohm 18 Ohm 22 Ohm 27 Ohm 33 Ohm 39 Ohm 47 Ohm 56 Ohm	50pcs.	$1.95
ASST. 2	5ea.	68 Ohm 82 Ohm 100 Ohm 120 Ohm 150 Ohm 180 Ohm 220 Ohm 270 Ohm 330 Ohm 390 Ohm	50pcs.	$1.95
ASST. 3	5ea.	470 Ohm 560 Ohm 680 Ohm 820 Ohm 1K 1.2K 1.5K 1.8K 2.2K 2.7K	50pcs.	$1.95
ASST. 4	5ea.	3.3K 3.9K 4.7K 5.6K 6.8K 8.2K 10K 12K 15K 18K	50pcs.	$1.95
ASST. 5	5ea.	22K 27K 33K 39K 47K 56K 68K 82K 100K 120K	50pcs.	$1.95
ASST. 6	5ea.	150K 180K 220K 270K 330K 390K 470K 560K 680K 820K	50pcs.	$1.95
ASST. 7	5ea.	1M 1.2M 1.5M 1.8M 2.2M 2.7M 3.3M 3.9M 4.7M 5.6M	50pcs.	$1.95
ASST. 8R		Includes Resistor Assts. 1-7 (350 pcs.)		$10.95 ea.

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INTERSIL

Part No.	Function	Price
7045IPI	CMOS Precision Timer	14.95
7045EV/Kit*	Stopwatch Chip, XTL	24.95
7106CPL	3½ Digit A/D (LCD Drive)	16.95
7106EV/Kit*	IC, Circuit Board, Display	34.95
7107CPL	3½ Digit A/D (LED Drive)	15.95
7107EV/Kit*	IC, Circuit Board, Display	29.95
7116CPL	3½ Digit A/D LCD Dis. HLD.	18.95
7117CPL	3½ Digit A/D LED Dis. HLD.	17.95
7201IDR	Low Battery Volt Indicator	2.25
7205IPG	CMOS LED Stopwatch/Timer	12.95
7205EV/Kit*	Stopwatch Chip, XTL	19.95
7206CJPE	Tone Generator	5.15
7206CEV/Kit*	Tone Generator Chip, XTL	12.95
7207AIPD	Oscillator Controller	6.50
7207AEV/Kit*	Freq. Counter Chip, XTL	13.95
7208IPI	Seven Decade Counter	17.95
7209IPA	Clock Generator	3.95
7215IPG	4 Func. CMOS Stopwatch CKT	13.95
7215EV/Kit*	4 Func. Stopwatch Chip, XTL	19.95
7216AIJI	8-Digit Univ. Counter C.A.	32.00
7216CIJI	8-Digit Freq. Counter C.A.	26.95
7216DIPI	8-Digit Freq. Counter C.C.	21.95
7217IJI	4-Digit LED Up/Down Counter	12.95
7218CIJI	8-Digit Univ. LED Drive	10.95
7224IPL	LCD 4½ Digit Up Counter DRI	11.25
7226AIJL	8-Digit Univ. Counter	31.95
7226AEV/Kit*	5 Function Counter Chip, XTL	74.95
7240IJE	CMOS Bin Prog. Timer/Counter	4.95
7242IJA	CMOS Divide-by-256 RC Timer	2.05
7250IJE	CMOS BCD Prog. Timer/Counter	6.00
7260IJE	CMOS BCD Prog. Timer/Counter	5.25
7555IPA	CMOS 555 Timer (8 pin)	1.45
7556IPD	CMOS 556 Timer (14 pin)	2.20
7611BCPA	CMOS Op Amp Comparator 5MV	2.25
7612BCPA	CMOS Op Amp Ext. Cmvr. 5MV	2.95
7621BCPA	CMOS Dual Op Amp Comp. 5MV	3.95
7631CCPE	CMOS Tri Op Amp Comp. 10MV	5.35
7641CCPD	CMOS Quad Op Amp Comp. 10MV	7.50
7642CCPD	CMOS Quad Op Amp Comp. 10MV	7.50
7660CPA	Voltage Converter	2.95
8038CCPD	Waveform Generator	4.95
8048CCPE	Monolithic Logarithmic Amp	21.60
8069CCQ	50ppm Band—GAP Volt Ref. Diode	2.50
8211CPA	Volt Ref/Indicator	2.95
8212CPA	Volt Ref/Indicator	2.95

74C

74C00	.39			74C221	1.95
74C02	.39	74C95	1.59	74C240	2.25
74C04	.39	74C107	1.89	74C244	2.25
74C08	.39	74C151	2.95	74C373	2.49
74C10	.39	74C154	3.95	74C374	2.59
74C14	.75	74C157	2.25	74C901	.69
74C20	.39	74C160	1.69	74C903	.69
74C30	.39	74C161	1.60	74C911	10.95
74C42	1.39	74C162	1.49	74C912	10.95
74C48	1.95	74C163	1.69	74C915	1.69
74C73	.79	74C164	1.59	74C917	10.95
74C74	.79	74C173	1.39	74C922	5.49
74C85	1.95	74C174	1.39	74C923	5.75
74C86	.99	74C175	1.19	74C925	7.50
74C89	6.95	74C192	1.69	74C926	7.50
74C90	1.29	74C193	1.69	80C95	.79
74C93	1.29	74C195	1.59	80C97	.79

LINEAR

LH0002CN	6.85			LM702H	.79
LM10CLH	4.50			LM703CN	.89
LM11CLH	4.75	LM340T-5	1.25	LM709N	.29
LH0070-OH	4.95	LM340T-12	1.25	LM710N	.79
TL071CP	.79	LM340T-15	1.25	LM711N	.79
TL072CP	1.39	LM341P-5	.75	LM723N	.69
TL074CN	2.49	LM341P-12	.75	LM733N	1.00
LH0082CD	35.80	LM341P-15	.75	LM739N	1.19
TL082CP	1.19	LM342P-5	.69	LM741CN	.35
TL084CN	2.19	LM342P-12	.69	MC1741SCG	3.00
LH0094CD	36.80	LM342P-15	.69	LM747N	.79
LM300H	.99	LM348N	1.25	LM748N	.59
LM301CN	.35	LM350K	5.75	LM1014N	2.75
LM302H	1.95	LF351N	.60	LM1310N	1.95
LM304H	1.95	LF353N	1.00	LM1458CN	.59
LM305H	.99	LF355N	1.10	LM1488N	1.25
LM307CN	.45	LF356N	1.10	LM1489N	1.25
LM308CN	1.00	LM358N	1.00	LM1496N	1.95
LM309H	1.95	LM359N	1.79	LM1556V	1.75
LM309K	1.25	LM370N	4.49	LM1800N	2.95
LM310CN	1.75	LM373N	3.25	LM1871N	5.49
LM311/CN	.90	LM377N	2.95	LM1872N	5.49
LM312H	2.49	LM380N	1.25	LM1877N-9	3.25
LM317MP	1.15	LM381N	1.95	LM1889N	3.20
LM317T	1.75	LM382N	1.79	LM1896N	1.75
LM317K	3.95	LM384N	1.95	LM2002T	1.49
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LM319N	1.95	LM387N	1.45	LM2878P	2.25
LM320K-5	1.35	LM389N	1.35	LM2896P-1	2.25
LM320K-12	1.35	LM392N	.69	LM3189N	2.95
LM320K-15	1.35	LF398N	4.00	LM3900N	.69
LM320T-5	1.25	LM399H	5.00	LM3905CN	1.25
LM320T-12	1.25	TL494CN	4.49	LM3909N	1.15
LM320T-15	1.25	TL496CP	1.75	LM3914N	3.95
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LM324N	.99	NE529A	4.95	LM3916N	3.95
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LM337T	1.95	NE555V	.39	ICL8038B	4.95
LM337MP	1.15	LM556N	.99	LM13080N	1.29
LM338K	6.95	NE564N	3.95	LM13600N	1.49
LM339N	.99	LM565N	1.25	75138N	1.95
LM340K-5	1.35	LM566CN	1.95	75450N	.89
LM340K-12	1.35	LM567V	1.25	75451CN	.39
LM340K-15	1.35	NE570N	4.95	75492	.89

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10 pf	.08	.06	.05	.001μF	.08	.06	.05
22 pf	.08	.06	.05	.0047μF	.08	.06	.05
47 pf	.08	.06	.05	.01μF	.08	.06	.05
100 pf	.08	.06	.05	.022μF	.09	.07	.06
220 pf	.08	.06	.05	.047μF	.09	.07	.06
470 pf	.08	.06	.05	.1μF	.15	.12	.10

100 VOLT MYLAR FILM CAPACITORS

.001mf	.12	.10	.07	.022mf	.13	.11	.08
.0022mf	.12	.10	.07	.047mf	.21	.17	.13
.0047mf	.12	.10	.07	.1mf	.27	.23	.17
.01mf	.12	.10	.07	.22mf	.33	.27	.22

+20% DIPPED TANTALUMS (Solid) CAPACITORS

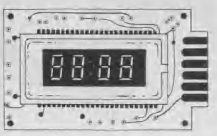
.1/35V	.39	.34	.29	1.5/35V	.41	.37	.29
.15/35V	.39	.34	.29	2.2/35V	.51	.45	.34
.22/35V	.39	.34	.29	3.3/25V	.53	.47	.37
.33/35V	.39	.34	.29	4.7/25V	.63	.56	.45
.47/35V	.39	.34	.29	6.8/25V	.79	.69	.55
.68/35V	.39	.34	.29	15/25V	1.39	1.25	.95
1.0/35V	.39	.34	.29	22/6V	.79	.69	.55

MINI. ALUMINUM ELECTROLYTIC CAPACITORS

Axial	1-99	100-499	500+	Radial	1-99	100-499	500+
.47/50V	.16	.14	.10	.47/25V	.15	.13	.12
1.0/50V	.19	.16	.12	.47/50V	.16	.14	.13
3.3/50V	.17	.15	.11	1.0/16V	.15	.13	.12
4.7/25V	.18	.15	.11	1.0/25V	.16	.14	.13
10/25V	.18	.15	.11	1.0/50V	.17	.15	.14
10/50V	.19	.16	.12	4.7/16V	.15	.13	.12
22/25V	.19	.16	.12	4.7/25V	.16	.14	.13
22/50V	.24	.20	.18	4.7/50V	.17	.15	.14
47/25V	.25	.21	.19	10/16V	.15	.13	.12
47/50V	.29	.25	.23	10/25V	.16	.14	.13
100/25V	.28	.24	.22	10/50V	.17	.15	.14
100/50V	.41	.37	.34	47/50V	.25	.21	.19
220/25V	.39	.34	.33	100/16V	.21	.17	.14
220/50V	.49	.45	.41	100/25V	.25	.23	.21
470/25V	.54	.49	.45	100/50V	.37	.34	.31
1000/16V	.79	.69	.61	220/16V	.25	.21	.19
2200/16V	.89	.79	.69	470/25V	.35	.31	.27

National Semiconductor Clock Modules

12VDC AUTOMOTIVE/ INSTRUMENT CLOCK



APPLICATIONS:
- In-dash autoclocks
- After-market auto/ RV clocks
- Aircraft-marine clks.
- 12VDC oper. instru.
- Portable/battery powered instruments.

Features: Bright 0.3" green display. Internal crystal time-base. ± 0.5 sec./day accur. Auto. display brightness control logic. Display color filterable to blue, blue-green, green & yellow. Complete – just add switches and lens.

MA1003 Module (3.05"L x 1.75"H x .98"D) . **$16.95**

CLOCK MODULES

MA1023 .7" Red Digital LED Clock Module	8.95
MA1026 .7" Dig. LED Alarm Clock/Thermometer	18.95
MA5036 .3" Red Digital LED Clock/Timer	6.95
MA1002 .5" Red Digital LED Clock & Xformer	9.95
MA1010 .8" Red Digital LED Clock	7.95
MA1032 CBA .5" Digital LCD Clock	17.95
MA1043 .7" Green Digital LED Clock	8.95

TRANSFORMERS

102-P20 Xformer for MA1023, 1043 & 5036 Mods.	3.49
102-P22 Xformer for MA1026 Clock Modules	3.49
102-P24 Xformer for MA1010 Clock Modules	3.49

NEW!

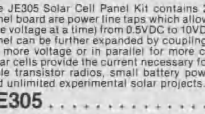
Sun Power Your Electronics! SOLAR CELL PANEL KIT

Features:
- Output: 10VDC, to 100mA in Series 5VDC, to 200mA in Parallel
- Panel may be easily connected for Series or Parallel out
- Over 11 square inches of active cell surface
- Voltage line tap @ 0.5V increments
- Provision for charging batteries
- Overall panel size: 4¾"L x 4½"H x ½"D

The JE305 Solar Cell Panel Kit contains 20 each solar cells. On the panel board are power line taps which allow the user to select voltages (one voltage at a time) from 0.5VDC to 10VDC. The applications of each panel can be further expanded by coupling additional panels in series for more voltage or in parallel for more current. The premium grade solar cells provide the current necessary for the operation of most portable transistor radios, small battery powered cassette tape players and unlimited experimental solar projects.

JE305 . . . . . **$39.95**

EPROM Erasing Lamp



- Erases 2708, 2716, 1702A, 5203Q, 5204Q, etc.
- Erases up to 4 chips within 20 minutes.
- Maintains constant exposure distance of one inch.
- Special conductive foam liner eliminates static build-up.
- Built-in safety lock to prevent UV exposure.
- Compact – only 7-5/8" x 2-7/8" x 2"
- Complete with holding tray for 4 chips.

UVS-11EL Replacement Bulb $16.95

UVS-11E **$79.95**

JOYSTICKS

JS-5K	5K Linear Taper Pots	$5.25
JS-100K	100K Linear Taper Pots	$4.95
JVC-40	40K (2) Video Controller in case	$4.95

ALLIGATOR CLIP TEST LEADS

Heavy-duty leads, color coded. Insulated alligator clip on each end, 15" long. Two each black, red, blue, white and yellow.

#ALCP (10 per pack) . . . . . **$2.95/pkg.**

NEW!

JE215 Adjustable Dual Power Supply

General Description: The JE215 is a Dual Power Supply with independent adjustable positive and negative output voltages. A separate adjustment for each of the supplies provides the user unlimited applications for IC current voltage requirements. The supply can also be used as a general all-purpose variable power supply.

FEATURES:
- Adjustable regulated power supplies, pos. and neg. 1.2VDC to 15VDC.
- Power Output (each supply): 5VDC @ 500mA, 10VDC @ 750mA, 12VDC @ 500mA, and 15VDC @ 175mA.
- Two, 3-terminal adj. IC regulators with thermal overload protection.
- Heat sink regulator cooling
- LED "on" indicator
- Printed Board Construction
- 120VAC input
- Size: 3-1/2"w x 5-1/16"L x 2"H

JE215 Adj. Dual Power Supply Kit (as shown) . . $24.95

(Picture not shown but similar in construction to above)

JE200 Reg. Power Supply Kit (5VDC, 1 amp) . . $14.95
JE205 Adapter Brd. (to JE200) ±5,±9 & ±12V. $12.95
JE210 Var. Pwr. Sply. Kit, 5-15VDC, to 1.5amp. $19.95

MICROPROCESSOR COMPONENTS

8080A/8080A SUPPORT DEVICES

INS8080A-4	CPU	4.95
DP8212	8-Bit Input/Output	3.25
DP8214	Priority Interrupt Control	5.95
DP8216	Bi-Directional Bus Driver	3.49
DP8224	Clock Generator/Driver	3.95
DP8226	Bus Driver	3.49
DP8228	System Controller/Bus Driver	4.95
DP8238	System Controller	5.95
INS8243	I/O Expander for 48 Series	9.95
INS8250	Asynchronous Comm. Element.	16.95
DP8251	Prog. Comm. I/O (USART)	6.95
DP8253	Prog. Interval Timer	8.95
DP8255	Prog. Peripheral I/O (PPI)	5.95
DP8257	Prog. DMA Controller	9.95
DP8259	Prog. Interrupt Control	9.95
DP8275	Prog. CRT Controller	19.95
DP8279	Prog. Keyboard/Display Interface	9.95
DP8303	System Timing Element	6.95
DP8304	8-Bit Bi-Directional Receiver	3.95
DP8307	8-Bit Bi-Directional Receiver	3.95
DP8308	8-Bit Bi-Directional Receiver	3.95
DP8310	Octal Latched Peripheral Driver	5.25
DP8311	Octal Latched Peripheral Driver	5.25

6800/6802 SUPPORT DEVICES

MC6800	MPU	7.95
MC6802CP	MPU with Clock and RAM	14.95
MC6810APT	128x8 Static RAM	4.95
MC6821	Peripheral Inter. Adapt (MC6820)	7.49
MC6828	Priority Interrupt Controller	17.95
MC6830L8	1024x8-Bit ROM (MC68A30-8)	14.95
MC6850	Asynchronous Comm. Adapter	6.95
MC6852	Synchronous Serial Data Adapter	6.75
MC6860	0-600bps Digital MODEM	10.95
MC6862	2400bps Modulator	12.95
MC6880A	Quad 3-State Bus Trans. (MC8T26)	2.25

MICROPROCESSOR CHIPS

Z80 (Z80C)	CPU (MK3880N) (2MHz)	11.95
Z80A (Z80-1)	CPU (MK3880N-4) (4MHz)	13.95
COP1802	CPU	19.95
2650	MPU	16.95
IDM2901ADC	CPU—4-Bit Slice (Com. Temp. Grade)	19.95
MC6802	MPU w/Clock (6K Bytes Memory)	11.95
INS8035N-6	MPU—8-Bit (6MHz)	7.95
INS8035N-6	CPU—Sgl. Chip 8-Bit (128 bytes RAM)	9.95
INS8040N-6	CPU (256 Bytes RAM)	24.95
INS8070N	CPU—64 Bytes RAM	24.95
INS8073N	CPU w/Basic Micro Interpreter	29.95
P8085	CPU	9.95
TMS9900JL	MPU—16-Bit	39.95

SHIFT REGISTERS

MM500H	Dual 25-Bit Dynamic	.50
MM503H	Dual 50-Bit Dynamic	.50
MM506H	Dual 100-Bit Static	.50
MM510H	Dual 64-Bit Accumulator	.50
MM1402N	256-Bit Dynamic	2.95
MM5013N	1024-Bit Dynamic/Accumulator	1.95
MM5016H	500/512-Bit Dynamic	1.95
MM5034N	Octal 80-Bit	9.95
MM5035N	Octal 80-Bit	9.95
2504V (1404A)	1024-Bit Dynamic	1.95
2518V	Hex 32-Bit Static	3.95
2522V	Dual 132-Bit Static	2.95
2524V	512-Bit Dynamic	.99
2525V	1024-Bit Dynamic	2.95
2527V	Dual 256-Bit Static	2.95
2528V	Dual 250-Bit Static	4.00
2529V	Dual 240-Bit Static	4.00
2532N	Quad 80-Bit Static	2.95
3341PC	Fifo (Dual 80)	6.95

DATA ACQUISITION

AF100-1CN	Universal Active Filter 2.5%	5.95
AF121-1CJ	Touch Tone Low Band Filter	19.95
AF122-1CJ	Touch Tone High Band Filter	19.95
LM308CH	Super Gain Op Amp	1.15
LM334Z	Constant Current Source	1.30
LM335Z	Temperature Transducer	1.40
LF356N	JFET Input Op Amp	1.10
LF398N	Sample & Hold Amplifiers	3.95
LM399H	Temp. Comp. Prec. Ref. (.5ppm/C°)	5.00
ADC0804LCN	8-Bit A/D Converter (1 LSB)	4.95
DAC0806LCN	8-Bit D/A Converter (0.78% Lin.)	2.25

DATA ACQUISITION (CONTINUED)

ADC0809CCN	8-Bit A/D Converter (8-Ch. Multi.)	5.25
ADC0817CCN	8-Bit A/D Converter (16-Ch. Multi.)	10.95
DAC1000LCN	10-Bit D/A Conv. Micro. Comp. (0.05%)	13.95
DAC1006LCN	10-Bit D/A Conv. Micro. Comp. (0.20%)	8.95
DAC1020LCN	10-Bit D/A Converter (0.05% Lin.)	8.49
DAC1022LCN	10-Bit D/A Converter (0.20% Lin.)	5.95
DAC1222LCN	12-Bit D/A Converter (0.20% Lin.)	9.95
CD4051N	8-Channel Multiplexer	1.19
AY-5-3013	30K BAUD UART	6.95

RAM'S

1101	256x1 Static	1.49
1103	1024x1 Dynamic	.99
2101 (8101)	256x4 Static	3.95
2102	1024x1 Static	1.75
2102	1024x1 Static	1.95
2111 (8111)	256x4 Static	3.95
2112	256x4 Static MOS	4.95
2114	1024x4 Static 450ns	3.25
2114L	1024x4 Static 450ns Low Power	3.49
2114-2	1024x4 Static 200ns	3.95
2114L-2	1024x4 Static 200ns Low Power	4.95
74S200	256x1 Static	8.95
4136N-4 (UPD416)	16K Dynamic 250ns (MM5290N-4)	2.95
4164N-3	64K Dynamic 200ns	19.95
MM2147J	4096x1 Fast 70ns	7.95
5101	256x4 Static	7.95
MM5261	1024x1 Dynamic Fully Decoded	.99
MM5262	2Kx1 Dynamic	.49
MM5280/2107	4096x1 Dynamic	4.95
MM5290N-2 (4116)	16K Dynamic 150ns (UPD416C-3)	3.95
MM5298J-3A	8K Dyn. 200ns (lower ½ of MM5290J)	1.95
HM6116-4	16K (2Kx8) Static 200ns	14.95
82S25	64 Bit RAM (16x4BC)	3.49
UPD414/MK4027	4K Dynamic 16-pin	4.95
TMS4044-45NL	4K Static	9.95
TMS4045	1024x4 Static	9.95

PROMS/EPROMS

1702A	2K UV Erasable PROM	5.95
2708	8K EPROM	4.95
TMS2716	16K EPROM (+5V, +5V, +12V)	9.95
2716 Intel (2516) TI	16K EPROM (Single +5V)	8.95
2732 Intel TI	32K EPROM	17.95
2758	8K EPROM (450ns) (Single +5V)	7.49
2764Q	64K EPROM (Hitachi HN462764)	49.95
5203	2048 PROM	14.95
82S23 (74S188)	32x8 PROM (Open Collector)	3.95
82S115	4096 Bipolar PROM	14.95
82S123 (74S288)	32x8 Tri-State Bipolar PROM	3.95
82S185	8K PROM	16.95

— Over 30 More PROMS Listed in Our Catalog —

ROM'S

2513 (2140)	Character Generator (Upper Case)	9.95
2513 (3021)	Character Generator (Lower Case)	9.95

NMOS READ ONLY MEMORIES

MCM66710P	128x9x7 ASCII Shifted w/Greek	13.50
MCM66740P	128x9x7 Math Symbol & Pictures	13.50
MCM66750P	128x9x7 Alpha, Control Char. Gen.	13.50

MICROPROCESSOR MANUALS

M-Z80	User Manual	7.50
M-CDP1802	User Manual	7.50
M-2650	User Manual	5.00

SPECIAL FUNCTION

DS0025CN	Dual MOS Clock Driver (5MZ)	3.50
DS0026CN	Dual MOS Clock Driver (5MZ)	1.95
INS1771N-1	Floppy Disc Controller	24.95
INS2651N	Communication Chip	19.95
MM58167N	Microprocessor Real Time Clock	8.95
MM58174N	Microprocessor Compatible Clock	11.95
COP402N	Microcontroller with 64-Digit RAM and Direct LED Drive	6.95
COP402MN	Microcontroller with 64-Digit RAM & Direct LED Drive w/N Buss Int.	7.49
COP470N	32-Seg.-VAC Fluor. Driver (20-pin pkg.)	3.25

TELEPHONE/KEYBOARD CHIPS

AY-5-9100	Push Button Telephone Dialer	14.95
AY-5-9200	Repertory Dialer	14.95
AY-5-9500	CMOS Clock Generator	4.95
AY-5-2376	Keyboard Encoder (88 keys)	11.95
HD0165-5	Keyboard Encoder (16 keys)	7.95
74C922	Keyboard Encoder (16 keys)	5.49
74C923	Keyboard Encoder (20 keys)	5.75
MM53190N	Push Button Pulse Dialer	7.95
MM57499N	96/144-Key Serial Keyboard Encoder	8.95

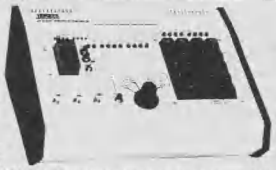
RADIO CONTROL CIRCUITS

Ideal for remote control systems which use pulse amplitude modulation (toy cars, boats, tanks, etc.). Features: five function control, adjustable steering angle, suitable for 27 and 47MHz bands and low power consumption.

KB-4428 TRANSMITTER **$4.25**
Abs. max. rating (TA @ 25°C): Supply volt.: Vcc1 12VDC. Power Dissipation: PD: 300mW. Temp. range: Oper. 0— +50°C — Storage -30— +125°C. Recommended oper. volt.: 7-11V. Crystal or CR Oscillation circuits acceptable.

KB-4429 RECEIVER **$5.95**
Abs. max. rating (TA @ 25°C): Supply volt.: Vcc1 11V. Vcc2 7.5V. Power Dissipation: 600W. Temp. range: Oper. 0 ± 50°C. Recommended oper. volt.: VOP1 7-11V — VOP2 3-6V

JE608 PROGRAMMER
2704/2708 EPROM PROGRAMMER



GENERAL APPLICATIONS:
- To program EPROMS 2704 and 2708.
- Developmental system for microcomputer circuits
- To read the contents of a pre-programmed EPROM
- To compare EPROM(s) for content differences
- To emulate a programmed EPROM
- To store program in RAMS for alterations
- Three separate Display Registers: 8 LED's for Hex Key entries, 10 LED's (2^4-2^9) for Address Register and 8 LED's for Data Memory Register. The Data Memory Register displays the content of the RAMs from the EPROM Chip. Development of microprocessor systems by means of a ribbon cable from the programmer panel test socket to the EPROM socket on the microprocessor board. Rapid checking verification of programmed data changes. User may move data from a master to RAM's or write into RAM's with keyboard entries. Allows manual stepping manipulation (up and down) at any address location. Stand-alone EPROM Programmer consisting of: A 19-key Hexadecimal Keyboard assembly. Programmer Board assembly with 4 power supplies and a LED/Test Socket Panel board assembly. The Test Socket is zero force insertion type. Power requirements: 115VAC, 60Hz, 6W. Compact desk-top enclosure: Color-coordinated designer's case with light tan panels and molded end pieces in mocha brown. Size: 3¼"H x 11"W x 8¼"D. Weight: 5 lbs.

The JE608 EPROM Programmer is a completely self-contained unit which is independent of computer control and requires no additional systems for its operations. The EPROM can be programmed from the Hexadecimal Keyboard or from a pre-programmed EPROM. The JE608 Programmer can emulate a programmed EPROM by the use of its internal RAM circuits. This will allow the user to test or pretest a program for a system, prior to programming a chip. Any changes in the program can be entered directly into the memory circuits with the Hexadecimal Keyboard so that rewriting the entire program will not be necessary. The JE608 Programmer contains a Programmer/Board w/25 IC's & includes power supplies of: -5V, +5V, +12V and +26V. The Hexadecimal Keyboard and LED/Test Socket Panel board are separate assemblies within the system.

JE608K Kit **$399.95**
JE608A Assembled and Tested **$499.95**

JE608-16K ADAPTER BOARD
FOR 2716/2758 EPROMS

GENERAL DESCRIPTION:
The JE608-16K Adapter Board allows the JE608 Programmer to be modified for the additional programming of the 2716 and 2758 EPROMS. The adapter provides for adding an address switch for the 2^11 bit and also for selecting the proper power and timing pulses to be applied to the EPROM. Programming and emulating the 2716 (16K) EPROM is done separately to each half (1024x8) of the EPROM because of the existing 8K RAM capacity in the JE608 Programmer.

JE608-16K	Adapter Board Kit	**$29.95**
JE608-Upgrade	(Send assembled JE608 to factory for adapter installation of the JE608-16K Adapter Board Kit)	**$99.95**
JE608A-16K Mod.	Assembled JE608 w/Adapter (JE608-16K) Installed	**$599.95**

$10.00 Min. Order – U.S. Funds Only
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Postage—Add 5% plus $1.50 Insurance

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BOOKS
National Semiconductor — Intersil — Intel

30001	**National CMOS Data Book** (640 pages) 74C, CD4000, and A/D Converters	$6.95
30002	**National Interface Data Book** (704 pages) DP, DS8000, DS3600, DS75000, etc.	$6.95
30003	**National Linear Data Book** (1376 pages) LM, LF, ADC, DAC, LH Series	$8.95
30004	**National Series 80 — Board Level Computer** (224 pages)	$4.95
30005	**National TTL Logic Data Book** (624 pages) 7400, LS, L, H, S, and DM8000 Series	$8.95
30006	**Buy above (3) 30001,3,5 as a set**	$19.95/1st
30009	**Intersil Data Book** (1074 pages)	$6.95
010400	**Intel Component Data Catalog** Full data sheets for Intel's products incl. memory devices, microproc., peripherals & indust./mil. products (1328 pages)	$10.00
205610	**Intel Peripheral Design Handbook** Full data sheets, appl. notes for Intel peripheral device components (644 pages)	$7.50

AC and DC Wall Transformers

Ideal for use with clocks, games, power supplies or any other type of AC or DC application.

Part No.	Input	Output	Price
AC 250	117V/60Hz	12 VAC 250mA	$3.95
AC 500	117V/60Hz	12 VAC 500mA	$4.95
AC1000	117V/60Hz	12 VAC 1 amp	$5.95
AC1700	117V/60Hz	9 VAC 1.7 amp	$3.95
DV 9200	117V/60Hz	9 VDC 200mA	$3.25
DC 900	120V/60Hz	9 VDC 500mA	$3.95

CONNECTORS

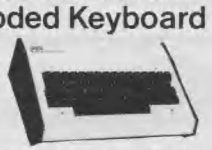
DB25P	D-Subminiature Plug	$2.95
DB25S	D-Subminiature Socket	$3.50
D20418-2	Screw Lock Hdwr. (2) DB25S/P	2/$.99
DB51226	Cover for DB25P/S	$1.75
22/44SE	P.C. Edge (22/44 Pin)	$2.95
UG88/U	BNC Plug	$1.79
UG89/U	BNC Jack	$3.79
UG175/U	UHF Adapter	$ .49
SO239	UHF Panel Recp.	$1.29
PL258	UHF Adapter	$1.60
PL259	UHF Plug	$1.60
UG260/U	BNC Plug	$1.79
UG1094/U	BNC Bulkhead Recp.	$1.29

TRS-80 16K Conversion Kit

Expand your 4K TRS-80 System to 16K.
Kit comes complete with:
★ 8 ea. MM5290 (UPD416/4116) 16K Dyn. Rams (*NS)
★ Documentation for Conversion

TRS-16K2 *150NS	$29.95
TRS-16K3 *200NS	$24.95
TRS-16K4 *250NS	$19.95

JE610 ASCII Encoded Keyboard Kit



The JE610 ASCII Keyboard Kit can be interfaced into most any computer system. The kit comes complete with an industrial grade keyboard switch assembly (62-keys), IC's, sockets, connector, electronic components and a double-sided printed wiring board. The keyboard assembly requires +5V @ 150mA and –12V @ 10 mA for operation. Features: 60 keys generate the 126 characters, upper and lower case ASCII set. Fully buffered. Two user-define keys provided for custom applications. Caps lock for upper-case-only alpha characters. Utilizes a 2376 (40-pin) encoder read-only memory chip. Outputs directly compatible with TTL/DTL or MOS logic arrays. Easy interfacing with a 16-pin dip or 18-pin edge connector. Size: 3½"H x 14½"W x 8¾"D

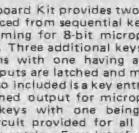
JE610/DTE-AK	(After assembled as pictured above)	**$124.95**
JE610 Kit	62-Key Keyboard, PC Board, & Components (no case).	**$ 79.95**
K62	62-Key Keyboard (Keyboard only)	**$ 34.95**
DTE-AK	(case only — 3¼"Hx11"Wx8¾"D)	**$ 49.95**

NEW!

JE212 — Negative 12VDC Adapter Board Kit for JE610 ASCII KEYBOARD KIT
Provides -12VDC from incoming 5VDC . . . **$9.95**

JE600 Hexadecimal Encoder Kit

FULL 8-BIT LATCHED OUTPUT 19-KEY KEYBOARD



The JE600 Encoder Keyboard Kit provides two separate hexadecimal digits produced from sequential key entries to allow direct programming for 8-bit microprocessor or 8-bit memory circuits. Three additional keys are provided for user operations with one having a bistable output available. The outputs are latched and monitored with 9 LED readouts. Also included is a key entry strobe. Features: Full 8-bit latched output for microprocessor use. Three user-define keys with one being bistable operation. Debounce circuit provided for all 19 keys. 9 LED readouts to verify entries. Easy interfacing with standard 16-pin IC connector. Only +5VDC required for operation. Size: 3½"H x 8¼"W x 8¾"D

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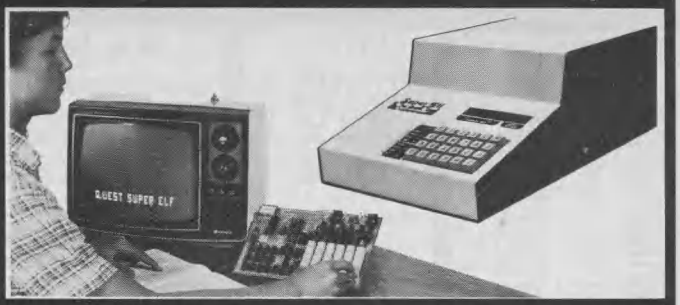

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The **Super Elf** includes a **ROM** monitor for program loading, editing and execution with **SINGLE STEP for program debugging** which is not included in others at the same price. With **SINGLE STEP** you can see the microprocessor chip operating with the **unique Quest** address and data bus displays **before, during** and **after** executing instructions. Also, CPU mode and instruction cycle are decoded and displayed on 8 LED indicators.

An RCA 1861 **video graphics** chip allows you to connect to your own TV with an inexpensive video modulator to do graphics and games. There is a **speaker system** included for writing your own music or using many music programs already written. The speaker amplifier may also be used to drive relays for control purposes.

A 24 key **HEX keyboard** includes 16 HEX keys plus **load, reset, run, wait, input, memory protect, monitor select** and **single step**. Large, on board displays provide output and optional **high and low address**. There is a 44 pin standard connector slot for PC cards and a 50 pin connector slot for the Quest Super Expansion Board. Power supply and sockets for **all** IC's are included in the price plus a detailed 127 pg. instruction manual which now includes over 40 pgs. of software info. including a series of lessons to help get you started and a music program and graphics target game. Many schools and universities are using the Super Elf as a course of study. OEM's use it for training and R&D.

Remember, other computers only offer Super Elf features at additional cost or not at all. **Compare before you buy. Super Elf Kit $106.95, High address option $8.95, Low address option $9.95. Custom Cabinet** with drilled and labelled plexiglass front panel **$24.95.** All metal Expansion Cabinet, painted and silk screened, with room for 5 S-100 boards and power supply **$57.00. NiCad Battery Memory Saver Kit $6.95.** All kits and options also completely assembled and tested.

Questdata, a software publication for 1802 computer users is available by subscription for $12.00 per 12 issues. Single issues $1.50. Issues 1-12 bound $16.50.

Free 14 page brochure. of complete Super Elf system.

Moews Video Graphics **$3.50.** Games and Music **$3.00,** Chip 8 Interpreter **$5.50.**

Super Expansion Board with Cassette Interface $89.95

This is truly an astounding value! This board has been designed to allow **you** to decide how you want it optioned. **The Super Expansion Board comes with 4K of low power RAM** fully addressable anywhere in 64K with built-in memory protect and a **cassette interface.** Provisions have been made for all other options on the same board and it fits neatly into the hardwood cabinet alongside the **Super Elf.** The board includes slots for up to 6K of **EPROM** (2708, 2758, 2716 or TI 2716) and is **fully socketed.** EPROM can be used for the monitor and Tiny Basic or other purposes. **A 1K Super ROM Monitor $19.95** is available as an on board option in 2708 EPROM which has been preprogrammed with a program loader/editor and error checking multi file cassette read/write software, (relocatable cassette file) another exclusive from Quest. It includes register save and readout, block move capability and video graphics driver with blinking cursor. Break points can be used with the register save feature to isolate program bugs quickly, then follow with single step. If you have the **Super Expansion Board** and **Super Monitor** the monitor is up and running at the push of a button.

Other on board options include **Parallel Input and Output Ports** with **full handshake.** They allow easy connection of an ASCII keyboard to the input port. **RS 232 and 20 ma Current Loop** for teletype or other device are on board and if you need more memory there are two **S-100** slots for static RAM or video boards. Also a 1K Super Monitor version 2 with video driver for full capability display with Tiny Basic and a video interface board. **Parallel I/O Ports $9.85, RS 232 $4.50, TTY 20 ma I/F $1.95, S-100 $4.50.** A **50 pin connector set** with ribbon cable is available at $15.25 for easy connection between the **Super Elf** and the **Super Expansion Board.**

Power Supply Kit for the complete system (see Multi-volt Power Supply).

Quest Super Basic V5.0

A new enhanced version of **Super Basic** now available. Quest was the first company worldwide to ship a full size Basic for 1802 Systems. A complete function **Super Basic** by **Ron Cenker** including floating point capability with scientific notation (number range $\pm 10^{-38}$), 32 bit integer ± 2 billion; multi dim arrays, string arrays; string manipulation; cassette I/O; save and load, basic, data and machine language programs; and over 75 statements, functions and operations.

New improved faster version including **renumber** and essentially **unlimited variables.** Also, an exclusive user expandable command library.

Serial and Parallel I/O included.

Super Basic on Cassette $55.00.

Type-N-Talk by Votrax

Text to speech synthesizer with unlimited vocabulary, built-in text to speech algorithm, 70 to 100 bits per second speech synthesizer, RS232C interface $345.00.

1802 16K Dynamic RAM Kit $149.00

Expandable to 64K. Hidden refresh w/clocks up to 4 MHz w/no wait states. Addl. 16K RAM **$25.00**

Tiny Basic Extended on Cassette	**$15.00**
(Added commands include Stringy, Array, Cassette I/O etc.) S-100 4-slot expansion	**$ 9.95**
Super Monitor VI.I Source Listing	**$15.00**

Elf II Adapter Kit $24.95

Plugs into Elf II providing Super Elf 44 and 50 pin plus S-100 bus expansion. (With Super Expansion). High and low address displays, state and mode LED's optional **$18.00.**

Super Color S-100 Video Kit $129.95

Expandable to 256 x 192 high resolution color graphics. 6847 with all display modes computer controlled. Memory mapped. 1K RAM expandable to 6K. S-100 bus 1802, 8080, 8085, Z80 etc. **Dealers: Send for excellent pricing/margin program.**

Editor Assembler	**$25.00**
(Requires minimum of 4K for E/A plus user source)	
1802 Tiny Basic Source listing	**$19.00**
Super Monitor V2.0/2.1 Source Listing	**$20.00**

PROM Eraser

assembled. 25 PROM capacity **$37.50** (with timer **$69.50**). 6 PROM capacity OSHA/UL version **$78.50** (with timer **$108.50**).

Z80 Microcomputer

16 bit I/O, 2 MHz clock, 2K RAM, ROM Breadboard space. Excellent for control. Bare Board **$28.50.** Full Kit **$99.00.** Monitor **$20.00.** Power Supply Kit **$35.00. Tiny Basic $30.00**

S-100 Computer Boards

8K Static Godbout Econo IIA Kit	149.00
16K Static Godbout Econo XIV Kit	269.00
24K Static Godbout Econo XX-24 Kit	414.00
32K Static Godbout Econo XX-32 Kit	537.00
16K Dynamic RAM Kit	289.00
32K Dynamic RAM Kit	328.00
64K Dynamic RAM Kit	399.00
Video Interface Kit	**$161.00**
Color Video Kit	129.95

81 IC Update Master Manual $79.95

Comp. IC data selector, 2 vol. master reference guide. Over 51,000 cross references. Free update service through 1981. Domestic postage $4.75.

Modem Kit $60.00

State of the art, orig., answer. No tuning necessary. 103 compatible 300 baud. Inexpensive acoustic coupler plans included. Bd. Only $17.00. Article in June *Radio Electronics*.

Gremlin Color Video Kit $69.95

32 x 16 alpha/numerics and graphics; up to 8 colors with 6847 chip; 1K RAM at E000. Plugs into Super Elf 44 pin bus. No high res. graphics. On board RF Modulator Kit **$4.95**

NiCad Battery Fixer/Charger Kit

Opens shorted cells that won't hold a charge and then charges them up, all in one kit w/full parts and instructions. **$9.95**

Rockwell AIM 65 Computer

6502 based single board with full ASCII keyboard and 20 column thermal printer. 20 char. alphanumeric display. ROM monitor, fully expandable. **$405.00.** 4K version **$450.00.** 4K Assembler **$85.00**, 8K Basic Interpreter **$100.00.**

Special small power supply for AIM65 assem. in frame **$54.00.** Complete AIM65 in thin briefcase with power supply **$499.00.** Molded plastic enclosure to fit both AIM65 and power supply **$47.50.** Special Package Price: 4K AIM, 8K Basic, power supply, cabinet **$625.00.**

AIM65/KIM/VIM/Super Elf 44 pin expansion board; 3 female and 1 male bus. Board plus 3 connectors **$22.95.**

60 Hz Crystal Time Base Kit $4.40

Converts digital clocks from AC line frequency to crystal time base. Outstanding accuracy.

Video Modulator Kit $9.95

Convert TV set into a high quality monitor w/o affecting usage. Comp. kit w/full instruc.

Multi-volt Computer Power Supply

8v 5 amp, ±18v .5 amp, 5v 1.5 amp, −5v .5 amp, 12v .5 amp, −12v option. ±5v, ±12v are regulated. Basic Kit **$35.95.** Kit with chassis and all hardware **$51.95.** Add $5.00 shipping. Kit of hardware **$16.00.** Woodgrain case **$10.00.** $1.50 shipping.

TERMS: $5.00 min. order U.S. Funds. Calif residents add 6% tax.
$10.00 min. BankAmericard and Master Charge accepted. $1.00 insurance optional.
Postage: Add 5%. C.O.D. $10.00 min. order.

FREE: Send for your copy of our NEW 1981 QUEST CATALOG. Include 48¢ stamp.

COMPONENTS

SN7400N	18	SN7482N	30
SN7402N	22	SN7492N	49
SN7404N	21	SN7493N	45
SN7408N	22	SN7495N	50
SN7410N	18	SN74196N	69
SN7412N	20	SN74122N	39
SN7413N	22	SN74136N	95
SN7414N	29	SN74141N	69
SN7416N	27	SN74151N	65
SN7417N	29	SN74153N	55
SN7420N	17	SN74154N	1.25
SN7425N	20	SN74155N	.75
SN7430N	17	SN74157N	58
SN7437N	26	SN74160N	89
SN7438N	24	SN74161N	65
SN7440N	18	SN74163N	85
SN7442N	45	SN74164N	87
SN7443N	42	SN74165N	55
SN7445N	64	SN74174N	88
SN7451N	19	SN74175N	79
SN7454N	19	SN74180N	.75
SN7474N	27	SN74181N	1.15
SN7475N	35	SN74393N	1.65

74LS00

74LS00	28	74LS158	.69
74LS02	28	74LS161	.83
74LS03	28	74LS162	.89
74LS04	28	74LS163	.98
74LS05	22	74LS164	.65
74LS08	29	74LS165	.65
74LS09	28	74LS169	1.55
74LS10	26	74LS170	1.75
74LS14	89	74LS174	.85
74LS20	22	74LS175	.85
74LS21	26	74LS190	.85
74LS26	40	74LS191	1.25
74LS27	27	74LS195	.95
74LS28	37	74LS197	.78
74LS30	29	74LS221	1.25
74LS32	31	74LS240	1.65
74LS38	31	74LS241	1.65
74LS42	63	74LS243	1.55
74LS48	77	74LS244	1.55
74LS74	38	74LS245	2.45
74LS75	55	74LS251	1.25
74LS86	45	74LS253	.85
74LS90	59	74LS257	.85
74LS93	65	74LS259	1.95
74LS96	80	74LS260	.55
74LS107	43	74LS273	1.55
74LS113	45	74LS279	.45
74LS122	45	74LS290	1.25
74LS123	89	74LS293	1.65
74LS125	89	74LS365	.85
74LS126	79	74LS367	.75
74LS138	64	74LS373	1.45
74LS139	59	74LS374	1.45
74LS151	49	74LS377	1.25
74LS153	49	74LS669	1.55
74LS157	69	74LS670	1.85

74S00

74S00	39	74S138	.75
74S02	45	74S140	1.00
74S03	38	74S158	.75
74S04	39	74S174	1.35
74S05	39	74S175	1.35
74S10	39	74S182	.75
74S15	45	74S189	4.25
74S20	55	74S201	6.75
74S22	55	74S240	2.75
74S30	75	74S244	2.95
74S37	55	74S251	2.75
74S50	65	74S287	2.95
74S51	49	74S288	2.95
74S64	55	74S299	5.75
74S74	65	74S470	9.25
74S86	95	74S471	9.50
74S112	1.95	74S473	9.50
74S132	1.45	74S474	9.50

EPROMS

2708	3.25ea	8 for	2.95ea
2716	5.50 ea	8 for	5.00ea
2732	12.95 ea	4 for	11.00 ea
4116	300NS 2.00ea	8 for	14.00
	200NS 2.35ea	8 for	18.00
2114L	300NS 2.25 ea	4 for	1.90ea
	200NS 2.45ea	4 for	2.00ea
2111	450NS 2.50ea	10 for	2.00ea

MISC.

		cont'd	
2102 450NS	.95		
8038	2.95	1103A	.75
NE555	.27	UPD765	19.85
AY5-1013A	4.25	floppy disk controller	w/spc
1488	.95	ULN2001	1.95
1489	.95	TMS4400	1.40
8T26	1.30	MC4008P	1.50
8T28	1.30	MH0026	1.55
8212	1.95	D3624	1.95
8216	1.95	D3001	1.95
IS410SCR	.85	D3002	1.95
IT410TRIAC	.85		
7905	.85		
7908	.85		
7915	.85		
7918	.85		
7805	.85		
7905	.85		
7808	.85		
7812	.85		
MC1330A1P	1.60		
MC1350P	1.15		
MC1358P	1.50		
LM380	1.10		
LM565N	.95		
LM741	.25		
MC1458P	.56		
LM720	.30		
LM386	1.30		

I.C. SOCKETS

	ww	p	st
		8	10/1.20
		14	10/1.30
		16	10/1.40
	10/5.30	18	10/1.80
	10/5.70	20	10/2.70
	10/8.70	22	10/2.70
	10/9.70	24	10/2.70
	10/12.70	28	10/3.00
	10/13.70	40	10/3.90
	10/14.70		solder
	10/17.70		
	wirewrap		

CPUs

Z-80	7.95
Z-80A CTC	10.50
Z-80A CPU	10.50
Z-80 002 16-64K	129.00
8085A	13.50
2901A	7.50
MC6800	9.50

SPECIALS

ZENITH ZVM-121
Video Monitor / Green !!
12 inch
15 MHz
$139.00

8255 → $7.95
8748-8 → $31.00
3341PC → $2.00
MM5060 → 35¢
MC6800 → $7.75
MC6802 → $14.95
MC6850 → $4.50
MC6821 → $4.95

CARDS

MICROSOFT:
Z80 $295.00
16K RAM $160.00
VIDEX:
VIDEOTERM
80 column
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EPSON:
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SPECIALS

3inch. COMPUTER FANS w/cord → $9.95
2111 → 256×4 Static RAM → $1.75
8155 → RAM, I/O, Timer → $11.50
ER2051 → EAROM → $4.95
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MC6800 → CPU → $7.75
UPD 765A → Floppy Disk Controller → $19.95
2732A → 250ns EPROM → $15.50
AY5 1013A → 30K Band UART → $2.95
93419 → 64×9 Static RAM → $5.50
2901A → 4-Bit Slice → $7.50

4inch FAN "Whisper" w/cord $8.95

REAL-TIME CLOCK CALENDAR (MSM 5832)

Description: Mono. Metal Gate CMOS I.C.

Features
Time, Month, Date, Year, & Day of Week
- Bus Oriented
- 4 Bit Data Bus
- 4 Bit Address
- R/W Hold Selec. +
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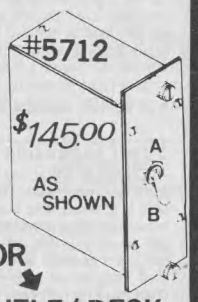
- 32.768Khz. xtal Control.
- 5v Pow. Sup.
- Low Power Dissipation

$7.45 W/SPEC's

XTAL $2.85



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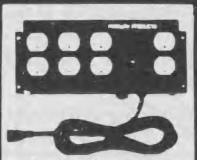
SHELF / DESK MOUNTED #5722
$155.00

DESC.
RS-232 COMPATABLE DIGITAL TRANSFER SWITCH WILL SWITCH MODEMS BETWEEN PROCESSORS / PRINTERS
24 PINS ARE SWITCHED. PIN 1 WIRED TO GROUND

Tbar INCORPORATED



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turns an ordinary outlet into a cont-rolled power source
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MODEL #CP198
input → 110/125v
output → 5vdc
At 6amps
$29.95
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BOOKS!

1981 I C MASTER 59.95
Sybex: "MICROPROCESSORS" 12.95
Osborne: "APPLE II USER'S GUIDE" 15.95

COMPUTERS

ATARI® 800™ COMPUTER SYSTEM

400 Computer 8K → $350.00
800 Computer 16K → $759.00
*800 COMPUTER w/48K → $898.00

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ATARI PERIPHERALS:

Printer ("825")	$775.00	Printer ("822")	$379.00
Recorder	$65.00	Disk Drive	$565.00
Interface (850)	$175.00	Modem	$169.00
Paddles	$17.00	Joysticks	$17.00

Star Raiders	$49.00	Assembler Editor	$49.00
Space Invaders	$17.00	Music Composer	$49.00
Chess	$32.00	Mailing List	$17.00
Kingdom	$12.00	TV Switch Box	$8.95
Hangman	$12.00	16K RAM	$155.00
Blackjack	$12.00	8K RAM	$119.00

NEW ATARI SOFTWARE

MISSLE COMMAND → $36.00
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VIDEO EASEL → $32.00
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"APPLE II Plus"

48k - $1199.00
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MONITORS

video 100
$129.00
12 inch
12 MHz
BLACK & WHITE
VIDEO MONITOR
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TERMINALS

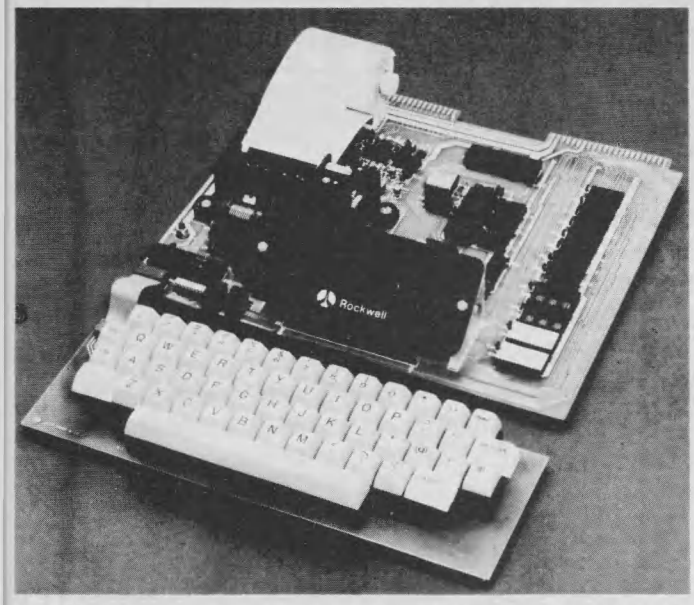
SOROC TECHNOLOGY INC

Synertek "KTM-3"

IQ120
$689.00

LOW COST TERMINAL WITH KEYBOARD AND VIDEO 100
$499.00

AIM 65 BY ROCKWELL INTERNATIONAL



AIM 65 is fully assembled, tested and warranted. With the addition of a low cost, readily available power supply, it's ready to start working for you.

AIM 65 features on-board thermal printer and alphanumeric display, and a terminal-style keyboard. It has an addressing capability up to 65K bytes, and comes with a user-dedicated 1K or 4K RAM. Two installed 4K ROMS hold a powerful Advanced Interface Monitor program, and three spare sockets are included to expand on-board ROM or PROM up to 20K bytes.

An Application Connector provides for attaching a TTY and one or two audio cassette recorders, and gives external access to the user-dedicated general purpose I/O lines.

Also included as standard are a comprehensive AIM 65 User's Manual, a handy pocket reference card, an R6500 Hardware Manual, an R6500 Programming Manual and an AIM 65 schematic.

AIM 65 is packaged on two compact modules. The circuit module is 12 inches wide and 10 inches long, the keyboard module is 12 inches wide and 4 inches long. They are connected by a detachable cable.

THERMAL PRINTER

Most desired feature on low-cost microcomputer systems . . .

- Wide 20-column printout
- Versatile 5 x 7 dot matrix format
- Complete 64-character ASCII alphanumeric format
- Fast 120 lines per minute
- Quite thermal operation
- Proven reliability

FULL-SIZE ALPHANUMERIC KEYBOARD

Provides compatibility with system terminals . . .

- Standard 54 key, terminal-style layout
- 26 alphabetic characters
- 10 numeric characters
- 22 special characters
- 9 control functions
- 3 user-defined functions

TRUE ALPHANUMERIC DISPLAY

Provides legible and lengthy display . . .

- 20 characters wide
- 16-segment characters
- High contrast monolithic characters
- Complete 64-character ASCII alphanumeric format

PROVEN R6500 MICROCOMPUTER SYSTEM DEVICES

Reliable, high performance NMOS technology . . .

- R6502 Central Processing Unit (CPU), operating at 1 MHz. Has 65K address capability, 13 addressing modes and true index capability. Simple but powerful 56 instructions.
- Read/Write Memory, using R2114 Static RAM devices. Available in 1K byte and 4K byte versions.
- 8K Monitor Program Memory, using R2332 Static ROM devices. Has sockets to accept additional 2332 ROM or 2532 PROM devices, to expand on-board Program memory up to 20K bytes.
- R6532 RAM-Input/Output-Timer (RIOT) combination device. Multipurpose circuit for AIM 65 Monitor functions.
- Two R6522 Versatile Interface Adapter (VIA) devices, which support AIM 65 and user functions. Each VIA has two parallel and one serial 8-bit, bidirectional I/O ports, two 2-bit peripheral handshake control lines and two fully-programmable 16-bit interval timer/event counters.

BUILT-IN EXPANSION CAPABILITY

- 44-Pin Application Connector for peripheral add-ons
- 44-Pin Expansion Connector has full system bus
- Both connectors are KIM-1 compatible

TTY AND AUDIO CASSETTE INTERFACES

Standard interface to low-cost peripherals . . .

- 20 ma. current loop TTY interface
- Interface for two audio cassette recorders
- Two audio cassette formats: ASCII KIM-1 compatible and binary, blocked file assembler compatible

ROM RESIDENT ADVANCED INTERACTIVE MONITOR

Advanced features found only on larger systems . . .

- Monitor-generated prompts
- Single keystroke commands
- Address independent data entry
- Debug aids
- Error messages
- Option and user interface linkage

ADVANCED INTERACTIVE MONITOR COMMANDS

- Major Function Entry
- Instruction Entry and Disassembly
- Display/Alter Registers and Memory
- Manipulate Breakpoints
- Control Instruction/Trace
- Control Peripheral Devices
- Call User-Defined Functions
- Comprehensive Text Editor

LOW COST PLUG-IN ROM OPTIONS

- 4K Assembler—symbolic, two-pass , **A65-010 $79.00**
- 8K BASIC Interpreter **A65-020 $99.00**

POWER SUPPLY SPECIFICATIONS

- +5 VDC ± 5% regulated @ 2.0 amps (max)
- +24 VDC ±15% unregulated @ 2.5 amps (peak) 0.5 amps average

PRICE: $389.00 (1K RAM) $439.00 (4K RAM)

Plus $4.00 UPS (shipped in U.S. must give ***street*** address), $10 parcel post to APO's, FPO's, Alaska, Hawaii, Canada, $25 air mail to all other countries

AIM 65 USER MANUAL $5.00 plus $1.50 shipping & handling.

We manufacture a complete line of high quality expansion boards. Use reader service card to be added to our mailing list, or U.S. residents send $1.00 (International send $3.00 U.S.) for airmail delivery of our complete catalog.

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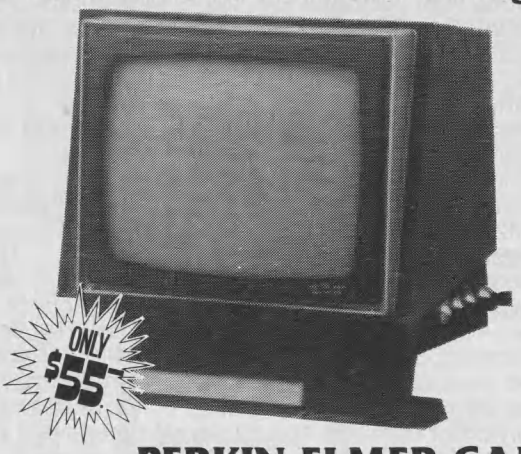
SELECTRONICS

Does it again. . . . high quality Sylvania monitors at the lowest prices ever. These monitors have been thoroughly checked and guaranteed.



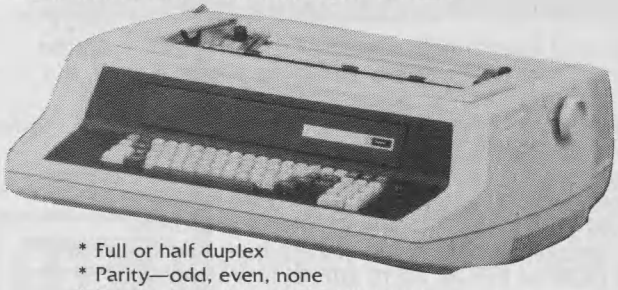
MONITORS

12" black & white monitor. Wide band, will display 80 x 24 char. 10K or 75Ω input impedance, composite video input. Transformer power supply.
Shpt. Wt. 30#
Price: $55 ea.
Used with all computers such as: TRS-80, Apple, and many others.
Complete manual $5.00.

PERKIN-ELMER CAROUSEL 350 TERMINAL

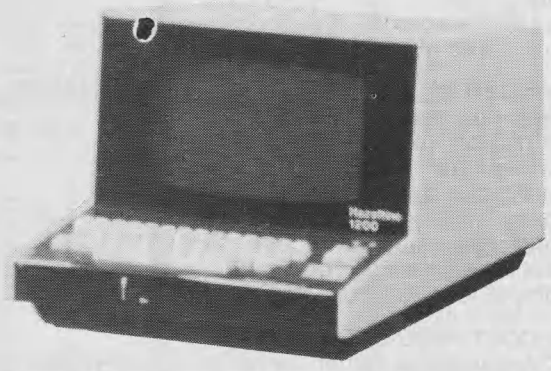
Only Selectronics could bring you this unbelievable opportunity to own the finest high-quality KSR terminal ever made. These machines originally listed for more than $4200. Check these outstanding features:

* Letter quality printing with upper and lowercase
* Microprocessor controlled
* 76-key alphanumeric keyboard with 10-key numeric pad
* EIA RS232C asynchronous serial interface
* 40 cps print rate
* 132 character buffer



* Full or half duplex
* Parity—odd, even, none
* Replacable print cups and elements

Excellent Condition—$750.00 F.O.B. our warehouse.
Shpt. Wt. 90#



HAZELTINE 1200 TERMINALS

SOLD OUT

24 x 80 character display; 5x7 dot matrix, Raster Scan, full ASCII keyboard; dc to 9600 baud; RS-232 interface; odd, even or no parity enable; full/half duplex, MOS-shift register memory with constant refresh.

ONLY $200.00

Also HAZELTINE 1000's

12 x 80 character baud rate 300
Shpt. Wt. 45#
FOB our warehouse
ONLY $150.00

ACOUSTIC COUPLE MODEM

sold out

Originate only 300 baud, full or half duplex
Shpt. Wt. 10#
ONLY $49.00

COMPUTER CARBONLESS PAPER

14-7/8 x 11, one-part. 3000 sheets per carton.
$24.00 per carton, 5 for $100.00
FOB Phila., Pa.
Shipping Weight 35 lbs.

DIGITAL DISPLAY BOARDS

6 digit numeric display boards with 6 FND 507. Common anode displays and 10 red LED's. With drivers & logic for multiplexed operation. Price: $5.00 ea. or 6/$25.00.

All items have been thoroughly checked and are in excellent working condition.

- Test Equipment
- Power Supply Components
- Power Supplies
- Communication Equipment
- Pulse Equipment

205

SELECTRONICS

Phone:
215-468-4645
215-468-7891

1206 S. Napa Street • Philadelphia PA 19146

Penna. resident please add 6% sales tax. **ALL PRICES ARE F.O.B.** our warehouse. Phila. PA. All merchandise accurate as to description to the best of our knowledge. Your purchase money refunded if not satisfied. Min. order $10.00.

Here we grow again !!!

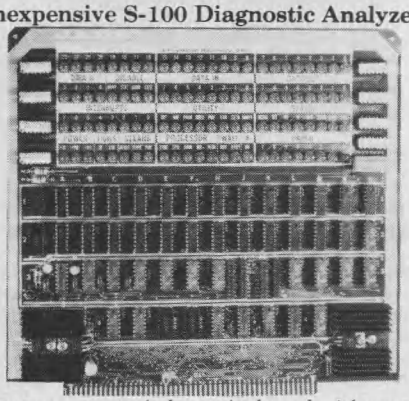
Grand Opening Sale

We're celebrating the latest addition to Jade's Retail Division - our new store located in Woodland Hills at 21800 Ventura Blvd.

New from Jade

The Bus Probe

Inexpensive S-100 Diagnostic Analyzer



So your computer is down. And you don't have an oscilloscope. And you don't have a front panel... You're not alone - most computers have their occasional bad days. But without diagnostic equipment such as an oscilloscope (expensive!) or a front panel (expensive!), it can be very difficult to pinpoint the problem. Even if you have an extender board with a superfast logic probe, you can't see more than one signal at a time. You're stuck, right?

Not anymore; Jade is proud to offer our cost-effective solution to the problems mentioned above: **THE BUS PROBE.**

Whether you're a hobbyist with a cantankerous kluge or a field technician with an anxious computer owner breathing down your neck, you'll find THE BUS PROBE speeds your repair time remarkably. Just plug in THE BUS PROBE and you'll be able to see *all* the IEEE S-100 signals in action. THE BUS PROBE allows you to see inputs, outputs, memory reads and writes, instruction fetches, DMA channels, vectored interrupts, 8 or 16 bit wide data transfers, plus the three bus supply voltages.

An on-board pulse generator can provide repetitive resets, interrupts, or wait states, for trouble shooting.

TSX-200B *Bare board* **$59.95**
TSX-200K *Kit* **$119.95**
TSX-200A *A&T* **$149.95**

4 MHz Z-80 CPU, 80 x 25 display with graphics and 8 colors, 32K RAM, 24K ROM, parallel/serial/cassette interfaces, upper/lower case, numeric keypad, 10 special function keys, uses CP/M 2.2.

NEC-8001A *32K CPU/keyboard* .. **$1095.00**
NEC-8012A *I/O with 32K RAM* ... **$695.00**
NEC-8031A *Dual disk unit* **$1095.00**
VDM-651200 *12" green CRT* **$269.95**
NEC-1202D *Hi-res RGB color CRT* **$1045.00**
VDC-651212 *12" color monitor* **$479.95**
NEC-9010S *CP/M 2.2 for NEC* **$150.00**
NEC-90005 *Gen. accting softwr* ... **$375.00**

Intersell

Sellum I

NEC Spinwriter w/ Intelligent Controller

Standard serial, Centronics parallel, and current loop interfaces • Selectable baud rates 50 to 19,200 • Automatic bidirectional printing • Logic seeking • 650 character buffer with optional 16K buffer • 55 characters per second print speed • Comes with vertical forms tractor, ribbon, thimble and cable • Diablo compatible software • Available with or without optional front panel

PRD-55511 *1K no front panel* **$2795.00**
PRD-55512 *16K no front panel* .. **$2895.00**
PRD-55515 *1K w/front panel* **$2995.00**
PRD-55516 *16K w/front panel* ... **$3095.00**

Intersell NEC 3500Q

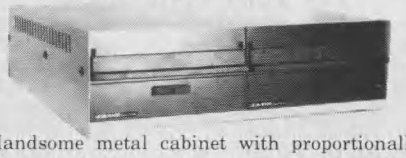
Intersell has announced that, available in September, they will offer a version of the new NEC Model 3500Q Spinwriter (30 cps) that will bring to the customer the same standard features as the Sellum I (except the tractor assembly which is optional on the 3500Q) but incorporating the added features of the NEC Model 3500Q

PRD-55351 *3500Q 1K* **$1995.00**
PRD-55352 *3500Q 16K* **$2095.00**
PRA-55100 *Deluxe tractor option* .. **$300.00**

JADE

Disk Sub-Systems

Shugart, Siemens, Qume



Handsome metal cabinet with proportionally balanced air flow system • Rugged dual drive power supply • Power cable kit • Power switch, line cord, fuse holder, cooling fan • Never-Mar rubber feet • All necessary hardware to mount 2-8" disk drives, power supply, and fan • Does not include signal cable

Dual 8" Subassembly Cabinet

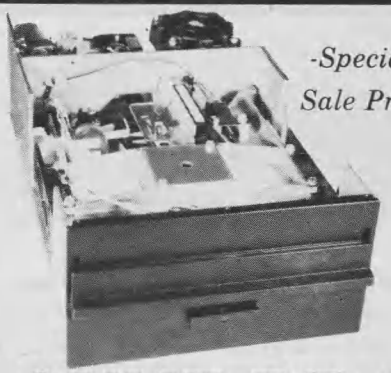
END-000420 *Bare cabinet* **$59.95**
END-000421 *Cabinet kit* **$225.00**
END-000431 *A & T* **$359.95**

8" Disk Drive Subsystems
Single Sided, Double Density

END-000423 *Kit w/2 FD100-8Ds* . **$924.95**
END-000424 *A & T w/2 FD100-8Ds* **$1124.95**
END-000433 *Kit w/2 SA-801Rs* .. **$999.95**
END-000434 *A & T w/2 SA-801Rs* **$1195.00**

8" Disk Drive Subsystems
Double Sided, Double Density

END-000426 *Kit w/2 DT-8s* **$1224.95**
END-000427 *A & T w/2 DT-8s* ... **$1424.95**
END-000436 *Kit w/2 SA-851Rs* .. **$1495.00**
END-000437 *A & T w/2 SA-851Rs* **$1695.00**



-Special Sale Price-

QUME DT-8

8" Double-Sided, Double-Density Disk Drive

1 Drive ... $524.95 each
2 Drives . $499.95 each
10 Drives $479.95 each

Jade Part Number MSF-750080

SIEMENS 8"

8" Single-Sided, Double-Density Disk Drive

1 Drive ... $384.95 each
2 Drives . $349.95 each
10 Drives $324.95 each

Jade Part Number MSF-201120

Shugart 801R

8" Single-Sided, Double-Density Disk Drive

1 Drive ... $394.95 each
2 Drives . $389.95 each

Jade Part Number MSF-10801R

MPI B-51

5¼" Single-Sided, Double-Density Disk Drive

1 Drive ... $234.95 each
2 Drives . $224.95 each
10 Drives $219.95 each

Jade Part Number MSM-155100

END-000213 *Case & power supply* **$74.95**

Micro-Sci

Apple Disk Drives

Increased Capacity - Decreased Price

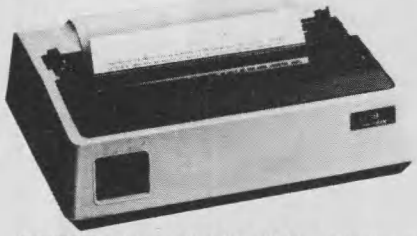
40 or 70 track drives • operates with DOS 3.2 and 3.3, Language System, and the Z80 Softcard • 40 and 70 track drives may be mixed on your Apple II • With two 40 track drives you get a 12.5% increase in capacity, 300% improvement in track-to-track access, and save about 15% • With two 70 track drives instead of four 35 track drives you get the same capacity, 300% improvement in track-to-track access time, and save about 45%.

IOD-2340A *A-40 with cable* **$399.95**
IOD-2370A *A-70 with cable* **$529.95**
IOD-2300A *Micro-sci controller* **$89.95**

Grand Opening Sale

★★★★★★ San Diego ★★★★★★ Hawthorne ★★★★★★ Woodland Hills ★★★★★★

Printers



BETTER THAN EPSON ! - Okidata

Microline 82A *80/132 column,* ***120 CPS****, 9 x 9 dot matrix, friction feed, pin feed, adjustable tractor feed (removable), handles 4 part forms up to 9.5" wide, rear & bottom feed, paper tear bar, 100% duty cycle/200,000,000 character print head, bi-directional/logic seeking, both serial & parallel interfaces included, front panel switch & program control of 10 different form lengths, uses inexpensive spool type ribbons, double width & condensed characters, true lower case descenders & graphics*

PRM-43082 *with FREE tractor* **$544.95**

Microline 83A *132/232 column, 120 CPS, handles forms up to 15" wide, plus all the features of the 82A.*

PRM-43083 *with FREE tractor* **$774.95**

PRA-27081A *Apple card* **$39.95**
PRA-27082A *Apple cable* **$19.95**
PRA-27087A *TRS-80 cable* **$24.95**
PRA-43080 *Extra ribbons pkg. of 2* ... **$9.95**

INEXPENSIVE PRINTERS - Epson

MX-70 *80 column, 80 CPS, 5 x 7 dot matrix, adjustable tractor feed, & graphics*

PRM-27070 *List $459* **$399.95**

MX-80 *80 column, 80 CPS, bi-directional/logic seeking printing, 9 x 9 dot matrix, adjustable tractor feed, & 64 graphics characters*

PRM-27080 *List $645* **$474.95**

MX-80FT *same as MX-80 with friction feed added.*

PRM-27082 *List $745* **$574.95**

MX-100 *132 column, correspondence quality, graphics, up to 15" paper, friction feed & adjustable tractor feed, 9 x 9 dot matrix, 80 CPS.*

PRM-27100 *List $945* **$795.00**

PRA-27084 *Serial interface* **$69.95**
PRA-27088 *Serial intf & 2K buffer* .. **$144.95**
PRA-27081 *Apple card* **$74.95**
PRA-27082 *Apple cable* **$22.95**
PRA-27086 *IEEE 488 card* **$52.95**
PRA-27087 *TRS-80 cable* **$32.95**
PRA-27085 *Graftrax II* **$95.00**
PRA-27083 *Extra ribbon* **$14.95**

Dual-Mode 200 - Malibu

200 CPS/9 x 9 matrix or 70 CPS/19 x 18 matrix for letter quality, stores up to 12 different fonts, hi-res dot graphics, single sheet and tractor feed, RS-232C and parallel interfaces

PRM-35200 *Dual-Mode 200* **$2695.00**

16K Atari ... $359.95

ATARI 800 - Atari

Complete personal computer with high resolution color graphics, built-in RF modulator, 4 controller ports, internal speaker, 16K RAM & 8K ROM

SYO-2080A *16K Atari 800* **$759.95**
Atari 800 with 32K of RAM **$799.95**
Atari 800 with 48K of RAM **$849.95**
SYO-2040A *16K Atari 400* **$359.95**
MSM-330810 *Disk drive* **$595.00**
MSM-330815 *Dual drive* **$1395.00**
IOX-5050A *850 interface* **$199.95**
MEX-16853K *16K RAM module* **$69.95**
SFI-241011005 *Visicalc* **$184.95**

Accessories for Apple

16K MEMORY UPGRADE

Add 16K of RAM to your TRS-80, Apple, or Exidy in just minutes. We've sold thousands of these 16K RAM upgrades which include the appropriate memory chips (as specified by the manufacturer), all necessary jumper blocks, fool-proof instructions, and our 1 year guarantee.

MEX-16100K *TRS-80 kit* **$25.00**
MEX-16101K *Apple kit* **$25.00**
MEX-16102K *Exidy kit* **$25.00**

16K RAM CARD - for Apple II

Expand your Apple to 64K, 1 year warranty

MEX-16500A *Save $70.00 !!!* **$129.95**

Z-80* CARD for APPLE

Two computers in one, Z-80 & 6502, more than doubles the power & potential of your Apple, includes Z-80 CPU card, CP/M 2.2, & BASIC-80*

CPX-30800A *A & T* **$299.95**

8" DISK CONTROLLER

New from Vista Computer, single or double sided, single or double density, compatible with DOS 3.2/3.3, Pascal, & CPM 2.2, Shugart & Qume compatible

IOD-2700A *A & T* **$499.95**

8" DRIVES for APPLE

Controller, DOS, two 8" double densisty drives, cabinet, power supply, & cables

Special Package Price *Kit* **$1399.95**

CPS MULTICARD - Mtn. Computer

Three cards in one! Real time clock/calendar, serial interface, & parallel interface - all on one card.

IOX-2300A *A & T* **$199.95**

APPLE CLOCK - Cal Comp Sys

Real time clock w/battery back-up

IOK-2030A *A & T* **$109.95**

PRINTER INTERFACE - C.C.S.

Centronics type I/O card w/ firmware

IOI-2041A *A & T* **$99.95**

AIO, ASIO, APIO - S.S.M.

Parallel & serial interface for your Apple (see Byte pg 11)

IOI-2050K *Par & Ser kit* **$139.95**
IOI-2050A *Par & Ser A & T* **$169.95**
IOI-2052K *Serial kit* **$89.95**
IOI-2052A *Serial A & T* **$99.95**
IOI-2054K *Parallel kit* **$69.95**
IOI-2054A *Parallel A & T* **$89.95**

A488 - S.S.M.

IEEE 488 controller, uses simple basic commands, includes firmware and cable, 1 year guarantee, (see April Byte pg 11)

IOX-7488A *A & T* **$399.95**

Accessories for TRS-80

DISK DRIVES for TRS-80

23% more storage, 8 times faster, 40 track with free patch, 120 day warranty.

MSM-12410C *Save $125.00 !!!* **$325.00**

8" DISK DRIVES for MODEL II

2 double density drives with cabinet, power supply, & cables

END-000433 *Kit* **$1050.00**
END-000434 *Assembled* **$1250.00**
WCA-5036A *Cable (required)* **$29.95**

EPROM ERASERS

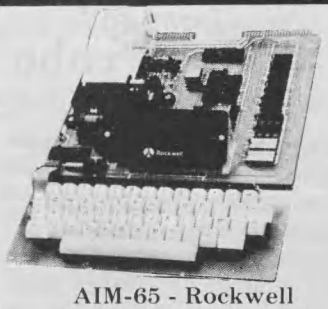
L.S. Engineering UV eraser for up to 48 EPROMs

XME-3200 *A & T* **$39.99**

Spectronics hi intensity industrial eraser

XME-3100 *Without timer* **$69.50**

Single Board Computers



AIM-65 - Rockwell

6502 computer with alphanumeric display, printer, & keyboard, and complete instructional manuals

CPK-50165 *1K AIM* **$424.95**
CPK-50465 *4K AIM* **$474.95**
SFK-74600008E *8K BASIC ROM* ... **$69.95**
SFK-64600004E *4K assembler ROM* **$39.95**
PSX-030A *Power supply* **$64.95**
ENX-000002 *Enclosure* **$54.95**

4K AIM, 8K BASIC, power supply, & enclosure

Special package price **$659.95**

Z-80* STARTER KIT - SD Systems

Complete Z-80 computer with RAM, ROM, I/O, display, keyboard, manual, and kluge area.*

CPS-30010K *Kit* **$369.95**
CPS-30010A *A & T* **$459.95**

SYM-1 - Synertek Systems

Single board computer with 1K of RAM, 4K of ROM, key-pad, LED display, 20ma & cassette interface on board.

CPK-50020A *A & T* **$249.95**

Video Terminals

AMBER SCREEN - Volker Craig

Detachable keyboard, amber on black display, 7 x 9 dot matrix, 10 program function keys, 14 key numeric pad, 12" non-glare screen, 50 to 19,200 baud, direct cursor control, auxiliary bi-directional serial port

VDT-351200 *List $795.00* **$645.00**

VIEWPIONT - ADDS

Detachable keyboard, serial RS232C interface, baud rates from 110 to 19,200, auxiliary serial output port, 24 x 80 display.

VDT-501210 *Sale Priced* **$639.95**

TELEVIDEO 950

Detachable keyboard, split screen with line lock, etched CRT, programmable function keys, on-screen status line, buffered auxiliary port, 14 x 10 dot matrix, self test, serviced nation-wide by General Electric

VDT-901250 *List $1195.00* **$995.00**

Video Monitors

HI-RES 12" GREEN - Zenith

15 MHz bandwidth, 700 lines/inch, P31 green phosphor, switchable 40 or 80 columns, small, light-weight & portable.

VDM-201201 *List price $150.00* **$118.95**

Leedex / Amdek

Reasonably priced video monitors

VDM-801210 *Video 100 12" B&W* .. **$139.95**
VDM-801230 *Video 100-80 12" B& W* **$179.95**
VDM-801250 *12" Green Phospor* **$169.95**
VDC-801310 *13" Color I* **$379.95**

12" COLOR MONITOR - NEC

Hi-res monitor with audio & sculptured case

VDC-651212 *Color Monitor* **$479.95**

12" GREEN SCREEN - NEC

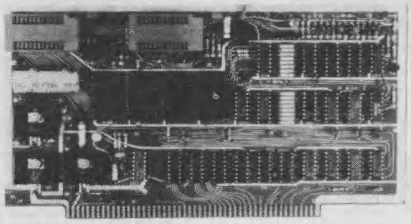
20 MHz, P31 phosphor video monitor with audio, exceptionally high resolution - A fantastic monitor at a very reasonable price

VDM-651200 *12" monitor* **$269.95**

Grand Opening Sale

★★★★★★ *San Diego* ★★★★★★ *Hawthorne* ★★★★★★ *Woodland Hills* ★★★★★★

S-100 PROM Boards



PB-1 - S.S.M.

2708, 2716 EPROM board with built-in programmer

MEM-99510K *Kit* $154.95
MEM-99510A *A & T* $219.95

PROM-100 - SD Systems

2708, 2716, 2732, 2758, & 2516 EPROM programmer

MEM-99520K *Kit* $219.95
MEM-99520A *Jade A & T* $269.95

EPROM BOARD - Jade

16K or 32K uses 2708's or 2716's, 1K boundary

MEM-16230K *Kit* $79.95
MEM-16230A *A & T* $119.95

S-100 Video

VB-3 - S.S.M.

80 characters x 24 lines expandable to 80 x 48 for a full page of text, upper & lower case, 256 user defined symbols, 160 x 192 graphics matrix, memory mapped, has key board input.

IOV-1095K *4 MHz kit* $349.95
IOV-1095A *4 MHz A & T* $439.95
IOV-1096K *80 x 48 upgrade* $39.95

VDB-8024 - SD Systems

80 x 24 I/O mapped video board with keyboard I/O, and on-board Z-80A.*

IOV-1020K *Kit* $399.95
IOV-1020A *Jade A & T* $459.95

VIDEO BOARD - S.S.M.

64 characters x 16 lines, 128 x 48 matrix for graphics, full upper/lower case ASCII character set, numbers, symbols, and greek letters, normal/reverse/blinking video, S-100.

IOV-1051K *Kit* $149.95
IOV-1051A *A & T* $219.95
IOV-1051B *Bare board* $34.95

Motherboards

ISO-BUS - Jade

Silent, simple, and on sale - a better motherboard

6 Slot (5¼" x 8⅝")

MBS-061B *Bare board* $19.95
MBS-061K *Kit* $39.95
MBS-061A *A & T* $49.95

12 Slot (9¾" x 8⅝")

MBS-121B *Bare board* $29.95
MBS-121K *Kit* $69.95
MBS-121A *A & T* $89.95

18 Slot (14½" x 8⅝")

MBS-181B *Bare board* $49.95
MBS-181K *Kit* $99.95
MBS-181A *A & T* $139.95

Mainframes

MAINFRAME - Cal Comp Sys

12 slot S-100 mainframe with 20 amp power supply

ENC-112105 *Kit* $329.95
ENC-112106 *A & T* $399.95

DISK MAINFRAME - N.P.C.

Holds 2 8" drives and a 12 slot S-100 system. Attractive metal cabinet with 12 slot motherboard & card cage, power supply, dual fans, lighted switch, and other professional features

ENS-112325 *with 25 amp p.s.* $699.95

S-100 Memory

MEMORY BANK - Jade

4 MHz, S-100, bank selectable, expandable from 16K to 64K

MEM-99730B *Bare board* $49.95
MEM-99730K *Kit, no RAM* $199.95
MEM-16730K *16K kit* $219.95
MEM-32731K *32K kit* $239.95
MEM-48732K *48K kit* $259.95
MEM-64733K *64K kit* $279.95
Assembled & tested ..... add $50.00

EXPANDORAM II - S D Systems

4 MHz RAM board expandable from 16K to 64K

MEM-16630K *16K kit* $275.95
MEM-32631K *32K kit* $295.95
MEM-48632K *48K kit* $315.95
MEM-64633K *64K kit* $335.95
Assembled & tested ..... add $50.00

64K RAM - Calif Computer Sys

4 MHz bank port / bank byte selectable, extended addressing, 16K bank selectable, PHANTOM line allows memory overlay, 8080 / Z-80 / front panel compatible.

MEM-64565A *A & T* $575.00

64K STATIC RAM - Mem. Merch.

64K static S-100 RAM card, 4-16K banks, up to 8 MHz

MEM—64400A *A & T* $825.00

32K STATIC RAM - Jade

2 or 4 MHz expandable static RAM board uses 2114L's

MEM-16151K *16K 4 MHz kit* $169.95
MEM-32151K *32K 4 MHz kit* $299.95
Assembled & tested ..... add $50.00

16K STATIC RAM - Mem Merchant

4 MHz 16K static RAM board, IEEE S-100, bank selectable, Phantom capability, addressable in 4K blocks, "disable-able" in 1K segments, extended addressing, low power

MEM-16171A *A & T* $174.95

S-100 Disk Controller

DOUBLE-D - Jade

Double density controller with the inside track, on-board Z-80A, printer port, IEEE S-100, can function on an interrupt driven buss*

IOD-1200K *Kit* $299.95
IOD-1200A *A & T* $375.00
IOD-1200B *Bare board* $59.95

VERSAFLOPPY II - SD Systems

New double density controller for both 8" & 5¼"

IOD-1160K *Kit* $339.95
IOD-1160A *A & T* $379.95

DOUBLE DENSITY - Cal Comp Sys

5¼" and 8" disk controller, single or double density, with on-board boot loader ROM, and free CP/M 2.2 and manual set.*

IOD-1300A *A & T* $369.95

S-100 I/O

S.P.I.C. - Jade

Our new I/O card with 2 SIO's, 4 CTC's, and 1 PIO

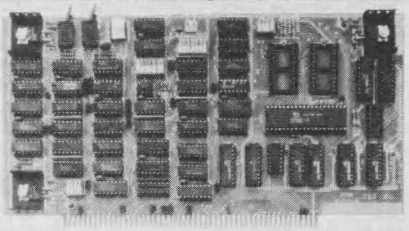
IOI-1045K *2 CTC's, 1 SIO, 1 PIO* .. $179.95
IOI-1045A *A & T* $239.95
IOI-1046K *4 CTC's, 2 SIO's, 1 PIO* $219.95
IOI-1046A *A & T* $299.95
IOI-1045B *Bare board w/ manual* ... $49.95

I/O-4 - S.S.M.

2 serial I/O ports plus 2 parallel I/O ports

IOI-1010K *Kit* $179.95
IOI-1010A *A & T* $249.95
IOI-1010B *Bare board* $35.00

S-100 CPU



CB-2 Z-80 CPU - S.S.M.

2 or 4 MHz Z-80 CPU board with provision for up to 8K of ROM or 4K of RAM on board, extended addressing, IEEE S-100, front panel compatible.

CPU-30300K *Kit* $239.95
CPU-30300A *A & T* $299.95

2810 Z-80* CPU - Cal Comp Sys

2-4 MHz Z-80A CPU with RS-232C serial I/O port and on-board MOSS 2.2 monitor PROM, front panel compatible.*

CPU-30400A *A & T* $269.95

SBC-200 - SD Systems

4 MHz Z-80 CPU with serial & parallel I/O ports, up to 8K of on-board PROM, software programmable baud rate generator, 1K of on-board RAM, Z-80 CTC.*

CPC-30200K *Kit* $339.95
CPC-30200A *Jade A & T* $399.95

THE BIG Z* - Jade

2 or 4 MHz switchable Z-80 CPU with serial I/O, accomodates 2708, 2716, or 2732 EPROM, baud rates from 75 to 9600*

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*This advertiser prefers to be contacted directly.

LETTERS TO THE EDITOR

(from page 30)

I am in complete agreement with Bob Stratton's comments, but would like to clarify a few points. I don't believe the STD bus will ever replace the S-100 either, and the purpose of the article was to acquaint readers with these new cards as a viable alternative to S-100. Granted, Pro-Log had the original idea but the bus was *developed* jointly by Pro-Log and Mostek. The packaged system offered by Pro-Log has no mass storage or extensive operating system, which basically limits it to engineering development.

The 8088 CPU Bob mentioned is not a true implementation of the STD bus, and peripheral cards must be chosen very carefully to ensure compatibility. There are several 16-bit implementations under way but they detract from the original purpose of the bus, to standardize all eight-bit machines.

As more of these cards and systems filter into homes and small businesses, standardization and compatibility will play a crucial role in its acceptance. That's one lesson it took S-100 manufacturers several years to finally figure out.

Don Langford
Hunstville, AL

Osborne the Obnoxious

Osborne the obnoxious, you betcha!

My local Osborne dealer wanted a $20 check-out fee to ascertain the machine wasn't DOA. Thanks but no thanks. Are there any others out there that have reacted similarly? Hidden charges may be OK but such a blatant disregard toward a paying customer I can't stomach.

Duncan Moyer
Auburn, CA

Alternatives to Ma Bell

A number of recent articles and news clips have correctly pointed out that there are a number of alternatives to the Bell System for low-cost toll telephone service. However, these articles have not mentioned Western Union's Metro I Low-Cost Toll Telephone Service.

Metro I provides service from the top 45 major metropolitan areas to 145 metropolitan areas. The backbone of the Metro I service offerings is the Western Union transcontinental microwave and satellite transmission network, which allows Western Union to have complete control over the end-to-end performance of our service.

The Metro I approach to the market is a combination of the best price and the most complete service. We have 24-hour per day computer monitoring of service quality and a grade of service which assures that 99 of 100 calls attempted will be completed on the first attempt. (Of course, this excludes situations where the called number is busy or does not answer.)

With AT&T's 16 percent toll telephone rate increase, two successive WATS rate increases, increasing many users' bills by 50 percent to 100 percent, and a 35 percent private line increase, I am sure your readers will want to know about the alternatives.

Joseph E. Lopez
Senior Product Manager
Specialized Communications
Western Union Telegraph Company

She Loves Me

Why in this day of micromarvels should the tormented lover bother to expend his energy plucking the petals from flowers to answer that age old query, "She loves me, she loves me not. . . ."? Now with the aid of modern technology (i.e., microcomputer with BASIC) you can know your fate in seconds. See Listing 1.

```
 10 PRINT "PROGRAM FOR THE
    LOVELORN"
 20 PRINT "SAVES TIME, EFFORT
    AND AGGRAVATION"
 30 PRINT "IS THE OBJECT OF
    YOUR DESIRE MALE(0) OR
    FEMALE(1)?"
 40 INPUT Y
 50 I=INT(100*RND)
 60 IF Y=1 GO TO 200
100 GOSUB 500
110 I=I-1
120 IF I=0 GO TO 700
130 GOSUB 520
140 I=I-1
160 IF I=0 GO TO 600
170 GO TO 100
200 GOSUB 400
210 I=I-1
220 IF I=0 GO TO 700
230 GOSUB 420
240 I=I-1
250 IF I=0 GO TO 600
260 GO TO 200
400 PRINT "SHE LOVES ME"
410 RETURN
420 PRINT "SHE LOVES ME NOT"
430 RETURN
500 PRINT "HE LOVES ME"
510 RETURN
520 PRINT "HE LOVES ME NOT"
530 RETURN
600 PRINT "SORRY KIDDO!"
610 PRINT "BETTER LUCK NEXT
    TIME"
620 PRINT "TRY AGAIN? NO=0,
    YES=1
630 INPUT Z
640 IF Z=1 GO TO 50
650 GO TO 1000
700 PRINT "WAS THERE EVER ANY
    DOUBT?"
1000 END
```

Listing 1

Many Thanks

I would like to thank David S. Ailes of Winter Park, FL, for his kind comments in the August Letters to the Editor on my thoughts expressed in Perspectives in the June *Microcomputing*.

Many of us out here would like to hear more about what he, and others like him, have been trying to do, and the problems he has encountered along the way. Some of us ought to be able to help him get full use out of his Apple computer.

I am also looking forward to *Desktop Computing*, which is targeted to bring together the people who need help and those who can give it. I think they call that user-friendly. By helping those who are just beginning to use micros, *Desktop Computing* also ought to swell the ranks of readership of *Microcomputing* with those ready to graduate.

Martin Klaver
Sicklerville, NJ

CALENDAR

Microcomputer Graphics Workshop

A one-day workshop designed as a practical preparation for making intelligent purchasing decisions will be held in Boston on Nov. 14. It will present an overview of applications, graphics features, system integration considerations, price ranges and information sources. Registration is $20.

For information, call or write Jean L. Graef, Cambridge Development Laboratory, 36 Pleasant St., Watertown, MA 02172 (617-926-0869).

COMDEX Show

The third annual COMDEX Conference and Exposition for independent sellers (ISOs) of small computer products will be held at the Las Vegas (NV) Convention Center Nov. 19–22. The conference will feature business, marketing and financial topics of relevance to ISOs.

For further information, write The Interface Group, 160 Speen St., Framingham, MA 01701 or call 800-225-4620 (in Massachusetts, 617-879-4502).

Philadelphia Area Computer Show

A show sponsored by the Philadelphia Area Computer Society will feature applications of small computers in education, business and leisure. Show dates: Nov. 12–14.

For further information contact Stephen A. Longo, Ph.D., Physics Department, La Salle College, Philadelphia, PA 19141 (215-951-1255).

California Computer Faire

The Silicon Gulch Games Faire & AppleFest will focus on electronic products for entertainment and Apple-related products. Scheduled for Nov. 21–22, at the San Jose Convention Center.

For further information, contact Computer Faire, 333 Swett Road, Woodside, CA 94062 (415-851-7075).

Symposium on Small Computers in the Arts

A wide range of presentations are planned to bring together people interested in using small computers in the audio and visual arts. The symposium will be held at the University City Holiday Inn on the campus of the University of Pennsylvania on Nov. 20–22.

For information, write to Symposium on Small Computers in the Arts, Box 1954, Philadelphia, PA 19105 (215-243-8109).

Teleconferencing Technologies Seminar

The Teleconferencing Technologies Seminar will be held at the Hilton Harvest House, Boulder, CO, on Dec. 7 and 8, 1981. The seminar will focus on how to use teleconferencing to conduct business transactions and improve effectiveness and decision-making. Demonstrations of computer, video and audio teleconferencing will be conducted, offering hands-on experience.

The seminar is jointly sponsored by Cross Communications Co. and Colorado Video Inc.

The cost of the seminar is $395, exclusive of meals and housing.

For further information contact Cross Communications Co., 934 Pearl, Boulder, CO 80302 (303-499-8888).

International Computer Music Conference

The 1981 International Computer Music Conference will be held Nov. 5–8, 1981, in Denton, TX.

For further information contact Larry Austin, School of Music, North Texas State University, Denton, TX 76203 (817-788-2791).

Consumer Electronics Show

The winter International Electronics Show will be held at the Las Vegas Convention Center Jan. 7–10.

For further information contact William T. Glasgow, Vice President, Consumer Electronics Shows, Two Illinois Center, Suite 1607, 233 North Michigan Ave., Chicago, IL 60601 (312-861-1040).

Micros in Education

Arizona State University is hosting the tenth annual Math/Science Conference on Jan. 15 and 16, 1982. The conference will focus on the microcomputer as a tool for instruction, as a research instrument and as an information manager.

For further information contact Nancy Watson, Conference Codirector, 203 Payne Hall, Arizona State University, Tempe, AZ 85287.

National Careers for the Disabled Symposium

The first National Careers for the Disabled Symposium will be sponsored by Commodore Business Machines, Inc., in association with Careers for the Disabled, Inc. The symposium will be held on Dec. 4–6, 1981, at the Convention Center in Baltimore, MD.

For additional information contact Careers for the Disabled, 261 Madison Ave., Suite 1102, New York, NY 10016.

NM Computer Fair

The New Mexico Computer Society will host the third annual New Mexico Computer Fair Saturday, Nov. 14, 1981, at the Albuquerque Civic Auditorium from 10 AM until 6 PM. There will be no charge for admission. For more information call Ron Benninghoff (505-831-3683 or 505-836-0065 after 4 PM Mountain time).

Computer Electronics Flea Market

The second annual SCARA Computer Electronics Flea Market will be held on Nov. 8, 1981, from 10 AM to 4 PM at the North Haven Recreation Center on Linseley St. in North Haven, CT. Refreshments will be served. Sellers' spaces are $5. Admission is $1, free for children under 12 with an adult. Special arrangements are available for dealers. Send check or M.O. (payable to SCARA) to PO Box 81, North Haven, CT 06473. SCARA is a nonprofit organization.

Texas Computer Show Postponed

James E. Myles, group show manager for Intercontinental Trade Shows Inc., has announced that the Texas Computer Show, scheduled to take place in the Dallas Convention Center from Jan. 20–22, 1982, has been postponed until March 9–11, 1983.

For more information contact James E. Myles (416-252-7791) or Catherine Manor (214-761-9108).

FORTH Interest Group National Convention

The FORTH Interest Group (FIG) announced the scheduling of its National Convention to be held Nov. 28, 1981, 9 AM–6 PM at the Santa Clara Marriott Hotel. This one day convention will include presentations, workshops, hands-on equipment and a number of vendor exhibits. An evening dinner will follow the day's activities and will feature a speaker. Registration is $3 with dinner extra.

The theme of the convention this year is education and the FORTH language and FORTH program applications. Papers are being solicited for presentation at the convention. Those wishing to present papers or exhibit should send a letter of intent to Convention Chairman, FORTH Interest Group, PO Box 1105, San Carlos, CA 94070.

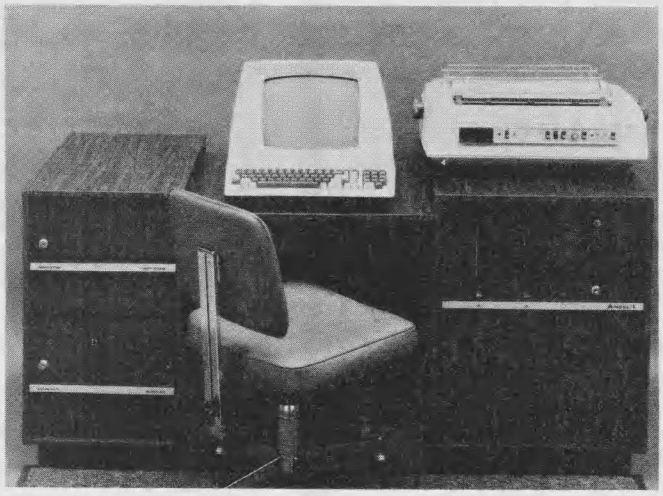
↙See List of Advertisers on page 210

Edited by Linda Stephenson

Micro for Those on the Go
Anacom Printers
Multi-User System

A Portable Computer With Battery Backup

Findex, 20775 South Western Ave., Torrance, CA 90501, has introduced a complete microcomputer system in a compact package. The Findex terminal-sized micro combines a keyboard, display, disk drive and printer. It interfaces to a variety of peripherals, such as larger printers or multiple hard-disk drives. Serial, parallel and S-100 bus interfaces are standard; American (Bell 103) and European (CCITT) acoustic couplers are optional. The Findex supports Business BASIC, COBOL, FORTRAN, Pascal, APL and PL/1. Applications software, including a patient accounting system for medical offices, is available from Findex. The computer will operate on 110 V, 200 V or 12 V. Battery backup allows the machine to operate for up to 30 minutes without outside power. The unit sells for $6980 to $20,000, depending on peripherals and software. Reader Service number 490.



The Angel-I development system from E. & U. Engel Consulting.

Paper-Saving Printers

The Anacom-160 and 160Z serial matrix printers are available from Anacom General Corporation, 1116 East Valencia Drive, Fullerton, CA 92631. These printers promise to end wasted forms forever—the paper-handling tractors are below the platen so that preprinted forms, after printing, can be torn within .050 inches of the print line. The head is designed for a print-life in excess of 600 million characters. The ribbon cartridge, which has a 3-million-character life, is clean and easy to handle and can be changed in seconds. The 160Z has dot-addressable graphics, compressed print, serial and parallel interface, x-on, x-off protocol and other features. The Anacom-160 costs $1750; the 160Z costs $2150. Reader Service number 493.

Multi-User System For Program Development

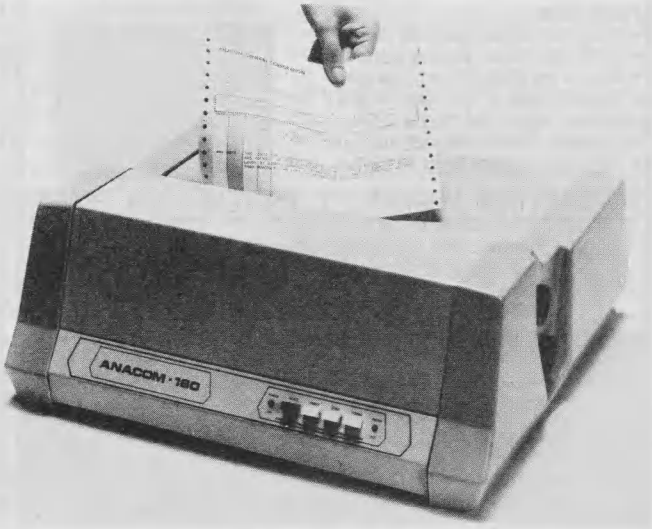
The Angel-I is a multi-terminal word- and data-processing system supporting up to 16 terminals. The CP/M-based Angel-I claims strong software support from over 400 vendors. The system comprises an S-100 bus, Z-80 CPU, 64K byte random access memory, two eight-inch disk drives, an 80-character CRT and a daisywheel printer, and is housed in a formica desk. Price is $7995. Various terminals and peripherals are also available from the supplier.

E. & U. Engel Consulting, 1719 S. Carmelina Ave., Los Angeles, CA 90025. Reader Service number 485.

PROM Blaster for TRS-80 or Apple

Apparat, Inc., 4401 S. Tamarac Parkway, Denver, CO 80237, is offering their

The Findex computer system.



The Anacom-160 printer.

JUDGE THE REST, THEN BUY THE BEST

Only GIMIX offers you **SOFTWARE SWITCHING** between **MICROWARE's OS-9** and **TSC's FLEX.** Plus you get the power of the GMXBUG system monitor with its advanced debugging utility, and memory manipulation routines. A wide variety of languages and other software is available for these two predominant 6809 Disk Operating Systems.

You can order a system to meet your needs, or select from the 6809 Systems featured below.

JUDGE THE FEATURES AND QUALITY OF GIMIX 6809 SYSTEMS

GIMIX' CLASSY CHASSIS™ is a heavyweight aluminum mainframe cabinet with back panel cutouts to conveniently connect your terminals, printers, drives, monitors, etc. A 3 position keyswitch lets you lock out the reset switch. The power supply features a ferro-resonant constant voltage transformer that supplies 8V at 30 amps, + 15V at 5 amps, and − 15V at 5 amps to insure against problems caused by adverse power input conditions. It supplies power for all the boards in a fully loaded system plus two 5 ¼'' drives (yes! even a Winchester) that can be installed in the cabinet. The Mother board has fifteen 50 pin and eight 30 pin slots to give you the most room for expansion of any SS50 system available. 11 standard baud rates from 75 to 38.4K are provided and the I/O section has its own extended addressing to permit the maximum memory address space to be used. The 2 Mhz 6809 CPU card has both a time of day clock with battery back-up and a 6840 programmable timer. It also contains 1K RAM, 4 PROM/ROM/RAM sockets, and provides for an optional 9511A or 9512 Arithmetic Processor. The RAM boards use high speed, low power STATIC memory that is fully compatible with any DMA technique. STATIC RAM requires no refresh timing, no wait states or clock stretching, and allows fast, reliable operation. The system includes a 2 port RS232 serial interface and cables. All GIMIX boards use gold plated bus connectors and are fully socketed. GIMIX designs, manufactures, and tests in-house its complete line of products. All boards are twice tested, and burned in electrically to insure reliability and freedom from infant mortality of component parts. All systems are assembled and then retested as a system after being configured to your specific order.

56KB 2MHZ 6809 SYSTEMS WITH GMXBUX/FLEX/OS-9 SOFTWARE SELECTABLE

With #58 single density disk controller **$2988.59**
With #68 DMA double density disk controller **$3248.49**
to substitute Non-volatile CMOS RAM with battery back-up, add 300.00
for 50 Hz export power supply models, add 30.00

Either controller can be used with any combination of 5" and/or 8" drives, up to 4 drives total, have data recovery circuits (data separators), and are designed to fully meet the timing requirements of the controller I.C.s.

5 ¼" DRIVES INSTALLED IN THE ABOVE with all necessary cables

	SINGLE DENSITY		DOUBLE DENSITY		
	Formatted	Unformatted	Formatted	Unformatted	
40 track (48TPI) single sided	199,680	250,000	341,424	500,000	2 for **$700.00**
40 track (48TPI) double sided	399,360	500,000	718,848	1,000,000	2 for **900.00**
80 track (96TPI) single	404,480	500,000	728,064	1,000,000	2 for **900.00**
80 track (96TPI) double	808,960	1,000,000	1,456,128	2,000,000	2 for **1300.00**

Chart shows total capacity in Bytes for 2 drives.

Contact GIMIX for price and availability of 8" floppy disk drives and cabinets; and 5" and 8" Winchester hard disk system.

128KB 2Mhz 6809 DMA Systems for use with TSC's UNIFLEX or MICROWARES's OS-9 Level 2

(Software and drives not included) **$3798.39**
to substitute 128KB CMOS RAM with battery back-up, add 600.00
for each additional 64KB NMOS STATIC RAM board, add 639.67
for each additional 64KB CMOS STATIC RAM board, add 988.64
for 50 Hz export power supply, add 30.00

NOTE: *UNIFLEX can not be used with 5" minifloppy drives.*

GIMIX has a wide variety of RAM, ROM, Serial and Parallel I/O, Video, Graphics, and other SS50 bus cards that can be added now or in the future. Phone or write for more complete information and brochure.

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GIMIX Systems are found on every continent, except Antarctica. (Any users there? If so, please contact GIMIX so we can change this.) A representative group of GIMIX users includes: **Government Research and Scientific Organizations** in Australia, Canada, U.K., and in the U.S.; NASA, Oak Ridge, White Plains, Fermilab, Argonne, Scripps, Sloan Kettering, Los Alamos National Labs, AURA. **Universities:** Carleton, Waterloo, Royal Military College, in Canada; Trier in Germany; and in the U.S.; Stanford, SUNY, Harvard, UCSD, Mississippi, Georgia Tech. **Industrial users** in Hong Kong, Malaysia, South Africa, Germany, Sweden, and in the U.S.; GTE, Becton Dickinson, American Hoechst, Monsanto, Allied, Honeywell, Perkin Elmer, Johnson Controls, Associated Press, Aydin, Newkirk Electric, Revere Sugar, HI-G/AMS Controls, Chevron. **Computer mainframe and peripheral manufacturers,** IBM, OKI, Computer Peripherals Inc., Qume, Floating Point Systems. **Software houses;** Microware, T.S.C., Lucidata, Norpak, Talbot, Stylo Systems, AAA, HHH, Frank Hogg Labs, Epstein Associates, Softwest, Dynasoft, Research Resources U.K., Microworks, Analog Systems, Computerized Business Systems.

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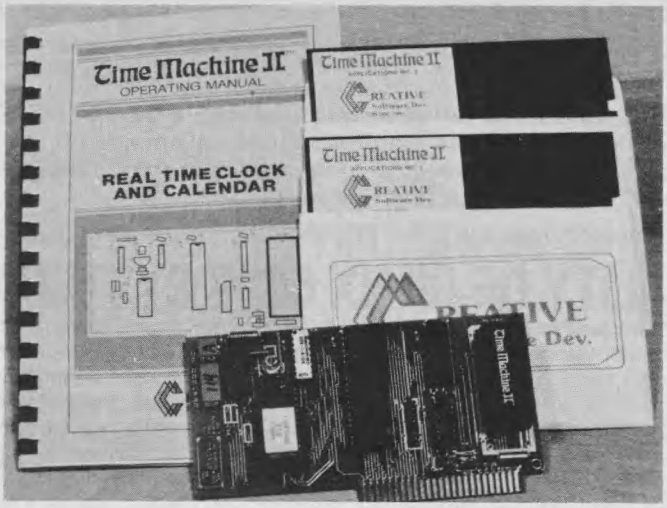


Time Machine II from Creative Software Development.

new PROM burner for the Apple II and TRS-80 Models I and III. The Apparat PROM blasting system (APB) will program nine different EPROMs on the same board. The APB will program model 2704, 2708, 2716, 2732, 2508, 2516 and 2532 EPROMs. The package includes the interface card, a complete set of personality modules, software on disk and a detailed instruction manual. Price is $149. Reader Service number 482.

Real-Time Clock and Calendar

Time Machine II is an intelligent real-time clock and calendar peripheral for the Apple II computer. It is crystal-controlled, and operates at a range of one second to 99 years. The 2048-byte firmware driver uses a dynamic bank switching technique and executes in the same space as other 256-byte clock drivers. Since bank switching occurs dynamically, all options are software selectable. A modified disk operating system adds the time and date to files each time they are modified. The catalog command has also been modified to display the current time and date. Time Machine II is priced at $135.

Creative Software Development, 4657 Thayn Drive, West Valley City, UT 84120. Reader Service number 486.

A Utility Printer

The Model DIP-81A is a reliable dot matrix printer designed for continuous duty cycle. The printer can accept data while printing, and can be readily interfaced with dumb CRT terminals, modems or Teletype replacement equipment. The Model DIP-81A features 7×7 or expanded 14×7 matrix printing, upper/lowercase character set, 100-characters-per-second bidirectional printout, clean ribbon-cartridge loading and a low profile. It uses sheet, roll or fanfold form paper. Centronics-compatible parallel interface is standard. The printer costs $499.

DIP, Inc., 745 Atlantic Ave., Boston, MA 02111. Reader Service number 483.

Five Megabytes of Memory

The LS525 5M memory system incorporates a Seagate ST506 5¼-inch Winchester disk drive, the LDOS disk operating system from Logical Systems, a Microcomputer Power Inc. linear power supply and Laredo's LSI 500 series controller. A separate off-board host adapter allows the LS525 to be cross-connected to most CPU and bus types. Up to three additional Winchester disk drives can be added to the system with no software modifications. All TRS-80 programs currently running under TRSDOS or NEWDOS will run under the LDOS operating system. The LS525 memory system is $3750.

Laredo Systems, Inc., 669 Giraudo Drive, San Jose, CA 95111. Reader Service number 491.

High-Speed Four-Port Interface

The CCS Model 2720 lets S-100 system users exchange bidirectional parallel data at high speeds with three peripherals and transmit parallel data to a fourth peripheral. Data is transferred at TTL levels on separate eight-bit input and output pathways, and a four-lines-per-port handshaking scheme ensures thorough communication protocol of both transmitter and receiver. A status register reflects each port's handshake activity so software can monitor the status of the input and output registers. Price is $250.

California Computer Systems, 250 Caribbean Drive, Sunnyvale, CA 94086. Reader Service number 488.

More Memory for Atari

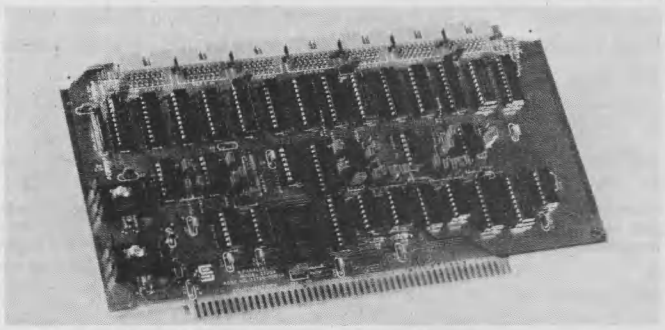
Axlon, Inc., 170 N. Wolfe Road, Sunnyvale, CA 94086, has announced its 128K byte memory system for the Atari 800. The RAMDISK memory system comes with software that makes the new system function like a disk device. The system can also be programmed as bank-selectable random access memory. The RAMDISK memory system and Atari 810 disk drive together are compatible with existing software written for the Atari 800 system. Function for function, the RAMDISK system is up to 20 times faster than the Atari 810. The price is $699. Reader Service number 489.

Table-Top Drum Plotter

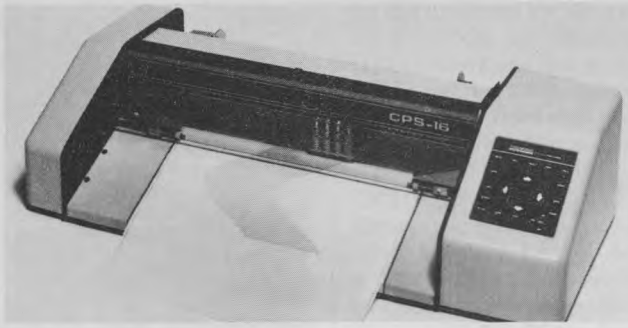
The CPS-16 is a space-saving four-pen plotter. It's designed to provide professional-quality output for drafting, surveying, business and other applications. The plotter produces four-color drawings in custom sizes on paper, mylar or vellum. It accepts data from either a standard EIA RS-232C or 20 mA current loop data source and can be operated on-line or in a timesharing environment. The CPS-16 features up to 172 firmware-generated characters containing upper/lowercase letters, positive paper feed, circular buffer memory and protocol for detection and correction of data transmission errors. Prices start at $10,900.

Houston Instrument, One Houston Square, Austin, TX

The DIP-81A dot matrix impact printer.



The CCS Model 2720 interface from California Computer Systems.



Houston Instrument's CPS-16 plotter.

78753. Reader Service number 498.

Disk Subsystem

The MS-800C disk subsystem is compatible with the Heath/Zenith-89, Apple II, TRS-80 Model II and all S-100-based units. The subsystem includes case, power supply, fan, cables and a choice of four different drive configurations: one single-sided drive, $1050; two single-sided drives, $1595; one double-sided drive, $1395; and two double-sided drives, $2095.

Matchless Systems, 18444 South Broadway, Gardena, CA 90248. Reader Service number 494.

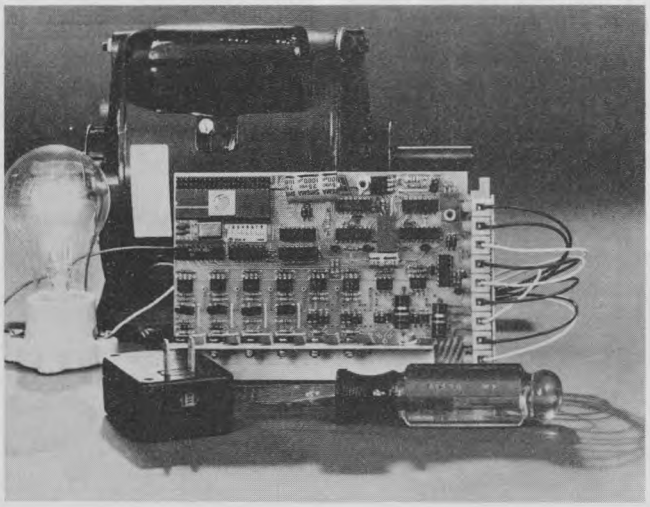
Distributed Control Micro

This new single board computer is configured as a remote terminal unit (RTU) for distributed control and remote data acquisition applications. The compact module includes a 6801 microprocessor, eight 12-bit analog inputs, eight-bit analog output, eight ac or dc inputs or outputs, serial I/O, watch-dog timer and power supply. The 6801 is programmed with C-net, a communications protocol that allows up to 31 RTUs in a net with one or more master computers. C-net permits the systematic transfer of commands, data and alarms between the masters and RTUs. Priced at $199.

Wintek Corp., 1801 South St., Lafayette, IN 47904. Reader Service number 487.

Memory Expansion For HP-9845

Eventide Clockworks Inc., 265 West 54th St., New York, NY 10019, offers a 512K byte memory board for Hewlett-Packard 9845-series microcomputers. The 9845s can accommodate up to three of these boards, providing a random access memory of 1.5 megabytes. A built-in hardware security system uses electronically embedded code which can be read by the proprietary program. If the code is missing or incorrect, the



Wintek's single board computer RTU.

↙See List of Advertisers on page 210

user will not be able to run the program.

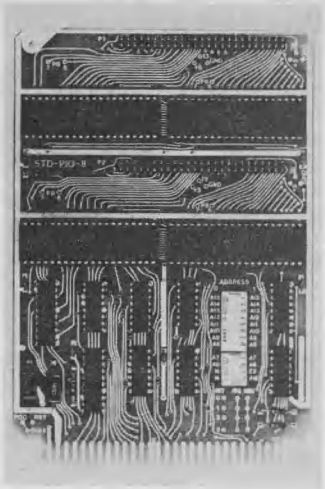
A programmer's utility package ROM can be ordered with the board to enhance programming productivity. It includes XREF, MAP, CHANGE, FIND, DUMP ALPHA and MSI commands. The WMAZ-4 board costs $6500; the utility ROM is $700 extra. Reader Service number 492.

Limited Distance Modem

International Data Sciences, Inc., 7 Wellington Road, Lincoln, RI 02865, has introduced the Model 6200 Limited Distance Modem. The modem is designed for asynchronous operation over private two- and four-wire non-loaded metallic conductors at speeds up to 19,200 bps. It can be used in both point-to-point and multidrop network configurations and is ideally suited for local data distribution up to nine miles. The modem employs a baseband modulation scheme that varies the voltages of the transmit signal on a balanced line, therefore requiring dc continuity. A built-in diagnostic capability helps verify system performance and isolate equipment failures in the communications link. The IDS Model 6200 is priced at $250. Reader Service number 484.

STD Bus Board

The STD-VIO8 I/O • Timer • Counter Board features eight programmable I/O ports. Each of its 64 I/O lines is individually programmable as an input or output, with 16 programmable handshake lines to permit high-speed data transfers to peripherals. Four 16-bit timers permit wide-range timing (2 μs to hours), automatic pulse output to an I/O line, and interrupt-on-time-out capabilities. Four 16-bit event counters monitor incoming I/O signals without CPU intervention. Four programmable shift registers permit serial data to be sent/received, and fully programmable interrupts on all functions avoid the overhead of software polling. Switch-selectable addressing aids system configuration, and 50-pin headers provide dependable connection to I/O devices.

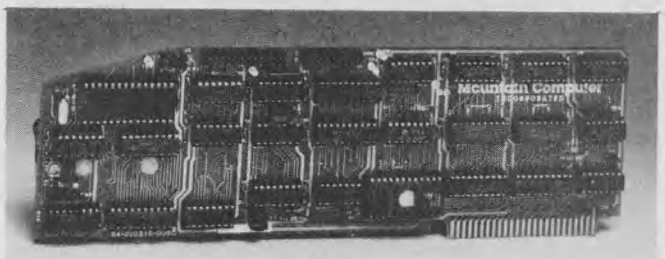


The STD-V108 Board from Forethought Products.

Forethought Products, 87070 Dukhobar Road, Eugene, OR 97402. Reader Service number 495.

Three Cards in One

The CPS MultiFunction card from Mountain Computer, Inc., 300 El Pueblo Road, Scotts Valley, CA 95066, provides a serial interface, a parallel output interface and a real-time calendar/clock for your Apple—on one card. Serial and parallel output can be used simultaneously. CPS is configured from a set-up program on disk that sets the parameters for all functions on the card and is stored in CMOS RAM on the card. Parameters can be changed



CPS MultiFunction card from Mountain Computer Inc.

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- **GO TO...DEPENDING ON.**
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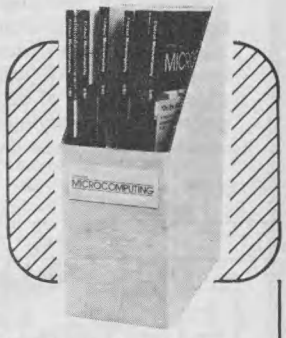

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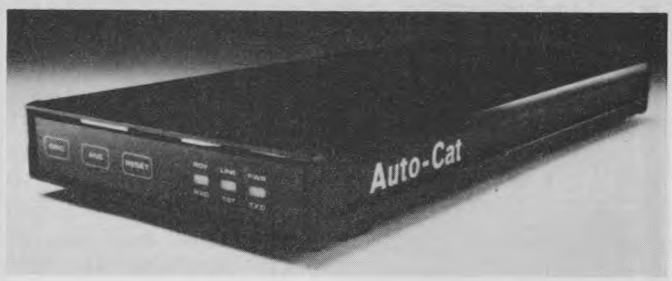


Novation's new modem automatically answers phone calls.

from the keyboard with control commands. All function setups stored on-board are battery-powered for up to two years. "Phantom slot" capability permits assigning each of the functions of CPS to different slots in your Apple without the card actually being in those slots. CPS's on-board intelligence lets it function in a wide variety of configurations, providing software compatibility with most existing programs. Reader Service number 497.

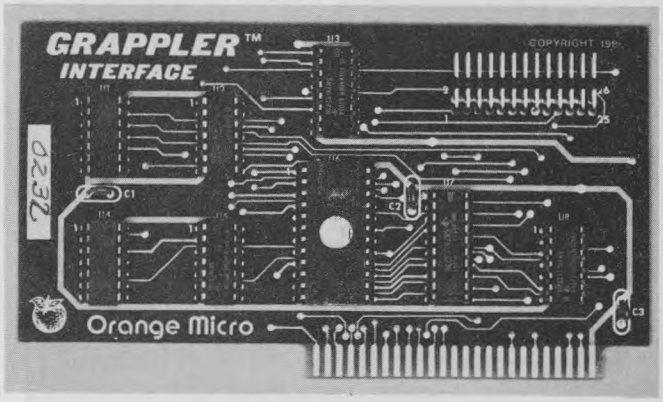
Data Communications

An FCC-approved auto-answer direct-connect modem is offered by Novation, Inc., 18664 Oxnard St., Tarzana, CA 91356. The Bell-103-compatible Auto-Cat will communicate at 300 bits per second (bps) over phone lines, using a standard modular jack. Its three data modes are automatic answer, manual answer and manual originate. It will operate in either full- or half-duplex, and features both local-and remote-loopback test functions. The interface between computer and modem is the EIA R-232. This compact modem uses a separate ac power supply that eliminates heat and voltage hazards. The Auto-Cat will automatically answer calls, permitting unattended operation of personal and business computers and terminals—data can be available 24 hours a day. Priced at $249. Reader Service number 499.

Hi-Res Graphics Interface

The Grappler is a Centronics-type parallel interface for the Apple II. It has on-board firmware to copy the Apple high-resolution graphics screen to many popular graphics printers. In the standard mode (for printing charts and graphs) each white dot on the screen is printed as a black dot on the paper. Inverse mode prints the opposite, for printing pictures. The double-size option prints each dot on the graphics screen as four dots on the printer. A chart recorder can be simulated by printing successive and continuous graphics pages. Text commands include text screen dumps, setting of margins and page lengths, auto-skip-over perforation and word wraparound with breakpoint on nearest blank.

Orange Micro, Inc., 3150 E. LaPalma #1, Anaheim, CA 92806. Reader Service number 496.



The Grappler from Orange Micro.

✓See List of Advertisers on page 210

CLUB NOTES

Portland Computer Society

The Portland Computer Society meets the third Saturday of each month at the Far West Federal Savings Community Meeting Room, 4770 SW 76, Portland, OR (503-292-4412).

Connecticut CP/M User's Group

The purpose of the Connecticut CP/M user's group is to bring CP/M users together to discuss CP/M-based hardware and software. The group meets the last Monday of each month. For more information contact The Wordsmith Network, 110 Day Hill Rd., Windsor, CT 06095 (203-683-2427).

Heath User's Group

Heathkit hobbyists have formed a local Heath user's group in Charlotte, NC. For details on the monthly meetings, contact Jim Simpson, HUG Charlotte, 2721 Picardy Place, Charlotte, NC (704-374-6997 or 375-1581).

OSI User's Group

The OSI user's group of southern Ontario will meet December 5, 1981, at McMaster University, Hamilton, Ontario. For further information contact Dr. N. Solntseff or Mr. C. Bryce, Unit for Computer Science, McMaster University, Hamilton, Ontario L8S 4K1 (416-525-9140 ext. 4689 or 2065).

South Florida User's Groups

The Ft. Lauderdale section of the South Florida Computer Group meets at the Social Annex, Holiday Park, Ft. Lauderdale, FL, the second Monday of each month at 8 PM. For more information contact Bob Haskins, 305-922-0955.

The Miami section meets the third Tuesday of each month at 8 PM at 240 NW 203 Terrace, Miami, FL. For further information contact Jerry Lofstead, 305-653-0669.

IBM Personal Computer User's Group

The Philadelphia Area IBM Personal Computer User's Group is being formed to stimulate communication among its members and members of other IBM microcomputer user's groups. A monthly newsletter will be published and group activities will be sponsored. Interested persons should contact Craig W. Uthe, 4101 Spruce St., Apt. 311, Philadelphia, PA 19104 (215-387-8208).

Osborne User's Group

The Osborne Business Software User's Group was recently formed to promote the use of Osborne/McGraw-Hill software. Membership in the group costs $10 a year and includes a subscription to the group newsletter, bug reports/fixes and access to additional compatible business software on eight-inch disks.

For further information contact John G. Ellis, Osborne Business Software User's Group, 2256 Main St., Suite 11, Otay, CA 92011 (714-423-0538).

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For Sale: I have over supply of new diskettes and other computer supplies. Too many to list here. SASE G. R. Davis, 16 W. Walnut Ave., Westmont, NJ 08108.

For Sale: Centronics 730 printer, same as Radio Shack Lineprinter II. New, only tested. Extra ribbons. $600. UPS COD. Dingley, 417 Liberty, Painesville, OH 44077. 216-354-5759.

For sale: insurance agency package. Univair package in CBASIC, list $750—selling for $600. D. P. Apt, 25102 Friar Lane, Southfield, MI 48034.

Word processing typewriter by Redactron. 15-inch model 745 I/O Selectric plus dual digital cassette drives. Can record, play back, edit, reformat, search tapes, merge text from one drive with addresses from other, etc. Excellent condition; recently factory overhauled. Operator's manual plus partial schematics included. $600 plus shipping. Bob Levine, 32 King St., New York, NY 10014. 212-691-2897.

For sale or trade: One RCA VIP microcomputer with 4K RAM, cassette I/O, hex keypad and graphics; with RF modulator included. Worth $199 new; sell for $135 US. Also have a Licon hall effect, 88-key keyboard with parallel ASCII converter. $90 new; sell for $80 US or best offer. Manuals included for both items. I will trade both for a HP-41C with manuals in good condition. Steve Gutz, RR#3, Pembroke, Ontario, Canada K1A 6W4.

Soft Sector Software: Electrical and audio engineering software for PET and Apple. Extensive graphics and printout capabilities. R. Majef, 534 Apollo, Richardson, TX 75081.

For sale: CT64 terminal $130, digital cassette drive $30, WW 6800 CPU brd (4K PROM w/listing, 2 PIA, 2 ACIA, 1K RAM) $30. John Aggers, 15742 Heywood Way, Apple Valley, MN 55124. 612-432-4483.

For sale: DEC VT103AA terminal, LSI-11/2, 96K memory 1 Megabyte dual floppy disk drive—RX02, RT11 Op. Sys. KED Text Editor, complete system, like new $8600. Howard C. Cooper, 630 N. 200 E., Kaysville, UT 84037. 801-766-1071 or 801-526-2601.

For sale: North Star Horizon 2. Includes two 5-inch double density disks, 48K RAM, sound gen. board, software, documentation and Hazeltine 1500 24 × 80 super terminal. Complete system: $2900. Duane Brummel, Rt. 2, Brookyn, WI 53521. 608-835-7554.

For sale: ASR 33 teletype with stand and manuals. Excellent condition. $250 plus shipping. John Dobiac, 101 S. Fox Rd., Sterling, VA 22170. 703-430-6950 after 6 PM.

For sale: 2114L2 memory chips, new—never used. All or part, $2.65 each. R. Van Cleave, 256 S. Tucson Circle, Aurora, CO 80012. 303-340-2955.

For sale: Diablo 1640KSR daisywheel printers, one new and one used, $2150 and $1950. TRS-80 printer III, used, $1200. San Jose, CA, call Chris 415-494-4557.

MICRO QUIZ

(from page 23)

Answer: 1, 2, 4, 5 and 3.
Array A has values 5, 3, 4, 2, 1.
Array R has values 3, 5, 2, 4, 1.
R(A(1)) = R(5) = 1
R(A(2)) = R(3) = 2
R(A(3)) = R(4) = 4
R(A(4)) = R(2) = 5
R(A(5)) = R(1) = 3

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Visit our Computer Support Center for the Inland Empire's largest selection of ICs, books and computer accessories. Open daily. Check our prices and friendly service. **Inland Electro-Mart, 8624 California Ave., Riverside, CA 92504. 687-3776.**

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Bay area's newest computer software store. Featuring Instant Software for the TRS-80, Apple, magazines, books. **Shaver Radio, 1378 S. Bascom Ave., San Jose, CA 95128. 998-1103.**

Gainesville, FL

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Melbourne, FL

Sales, service and leasing for Apple, SD systems, Altos, Atari, Mountain Computer, Intersystems, Epson, Anadex and Paper Tiger. Software, books, and magazines. Systems consulting. Mail order. **H.I.S. Computermation, Inc., 1295 Cypress Ave., Melbourne, FL. 254-9399.**

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We are the leading area computer store. We carry Cromemco, Apple, Vector Graphic; printers & terminals. We offer full software support including G/L, A/R, payroll & word processing. **Computer Centre, 909 S. Tamiami Trail, Nokomis, FL 33555. 484-1028.**

Sarasota, FL

Your personal and business computer store for Dynabyte, Vector, HP-85, Atari and Epson. Structured Systems and Micro-Pro software. Computer furniture and books by Osborne or Hayden. Sales, service and supplies. **Computer Crossroads, 3800 S. Tamiami Trail, Sarasota, FL 33579. 349-0200.**

Aurora, IL

Microcomputer systems for home or business; peripherals, software, books & magazines. Apple, Hewlett-Packard Series 80 Systems, HP Calculators, IDS, Qume, Starwriter printers. **Farnsworth Computer Center, 1891 N. Farnsworth Ave., Aurora, IL 60505. 851-3888.**

Herington, KS

Hardware support. Maintenance and service for all microcomputers and peripherals. Kits assembled or debugged. Radio Shack (mods OK) repaired. Quality work, fast turnaround and reasonable cost. **Prairie Micro Clinic, Box 325, Herington, KS 67449. 258-2179.**

Pasadena, MD

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Garden City, MI

Books, magazines, hardware and software for Apple, North Star, TRS-80 and PET. **Computer Center, 28251 Ford Rd., Garden City, MI 48135. 425-2470.**

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Apple Business Accounting
CBASIC-2 Screen Handler
H8 Speed-up

Real Estate Office Management

A CP/M software package that provides accounting and management information for real estate brokerage firms is available from Reality Automation, Inc., 221 North Lois, La Habra, CA 90631. It can handle one or more offices with one or more profit centers. The system includes a general ledger with profit and loss statements, balance sheets, trial balances and transaction registers. A chart of accounts developed by the National Association of Realtors is included, although the user can modify it or install his/her own chart of accounts.

The system permits office or division budgeting, and monthly, year-to-date and operating statement comparisons. Future cash flow estimates can be projected through the year-to-date budget. Accounts payable includes a checkwriter. A check can be entered once and will print monthly checks until removed. Price is $350. Reader Service number 464.

Apple Tree

First Edition is a computer conferencing package with general database and electronic mail features. Users enter messages and retrieve them via regular phone lines using a 48K Apple computer or terminal, disk drive and modem. Each new message is attached to others already in the database, allowing users to organize a conference tree of messages—any one of which can grow into a new conference or subconference. This tree structure makes it easier to find specific information and to enter information in the most appropriate part of the database.

Messages can be private or public. Seven different levels of password protection operate on the same system. Passwords are easy to change. Price is $95 with documentation.

Communitree Group, 470 Castro St., Suite 207-3002, San Fancisco, CA 94114. Reader Service number 466.

Business Accounting For the Apple

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GOCI Software, 9524 Briar Road, Bloomington, MN 55437. Reader Service number 470.

Data Security

An operating system for multi-user computer networks, offered by Digital Research, PO Box 579, Pacific Grove, CA 93950, features record and file locking and optional password protection. MP/M II can manage up to 400K bytes of random access memory. It includes utilities previously available only as options, such as a relocatable macroassembler, a linker with overlay facilities and a program library management utility. MP/M files are completely compatible with CP/M files. MP/M II comes on standard-format IBM single-density 8-inch floppy disk, priced at $450. Reader Service number 474.

MP/M II is a multi-user, multitasking operating system from Digital Research.

CBASIC-2 Screen Handler

Screenmaster is a screen-handler module provided in source code for inclusion in CBASIC-2 programs requiring full-screen or multi-screen input with automatic validation. The programmer has access before and after each input, and at submit time. CBASIC-2 code can be inserted to edit or control the program, overriding Screenmaster editing if necessary. The programmer and, optionally, the terminal user, have commands: GOTO (field) n, BACK/FORWARD n (fields), NEXT/PRIOR (screen), SUBMIT and ABORT. The output of Screenmaster is an in-memory array of user responses for further use by the programmer. Price is $195.

Marketing Essentials, Inc., 161 West 75th St., New York, NY 10023. Reader Service number 471.

Flexible Operating System

PCD Systems, Inc., PO Box 143, Penn Yan, NY 14527, is now offering the UCSD P-system version IV.0 operating system, which lets users run applications programs written

for one microcomputer on another—often without recompilation. The version IV.0 features the same operating system and utilities for a number of microprocessors, including the 8080, 8085, Z-8, Z-80, 6502, 6800, 6809 and the range of new 16-bit micros. It is fully supported to run on the TRS-80 Model II and Digital Equipment Corporation's LSI-11. The package includes the complete operating system for microcomputers (with the user's choice of Pascal, BASIC and FORTRAN compilers), a file handler, interpreter, screen and character editors, a macro assembler, linker and documentation. Price is $550 for FORTRAN or Pascal compilers, $450 for BASIC. Reader Service number 468.

An Adventure on the Apple

Muse Software, 330 N. Charles St., Baltimore, MD 21201, has introduced Castle Wolfenstein. This action-adventure game puts the player in the role of an Allied soldier in World War II. The castle itself is a magnificent Old World fortress occupied by the army of the Reich and converted into battlefront headquarters. The player, who has been captured and brought to Castle Wolfenstein for interrogation, is secretly slipped a loaded pistol by a dying cellmate. The player then assumes the game challenge: to find the Nazi war plans hidden in the castle and to escape.

The castle requires fast thinking and quick manual response. Castle Wolfenstein runs on an Apple II with 48K bytes of memory and one disk drive. Price is $29.95. Reader Service number 480.

Speed Up Your H8 Programs

Interactive Microware, Inc., PO Box 771, State College, PA 16801, offers their BASEX interactive compiler and loader programs on cassette for Heath H8 microcomputers. BASEX is an intermediate-level language that combines features of BASIC and executable machine-language code. BASEX programs run up to 10 times faster than similar BASIC programs, and program overhead is only 2K bytes for the execution routines. Price is $33. Reader Service number 465.

Solar Hot Water Program

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You'll need quick thinking and good reflexes to meet the challenge of Castle Wolfenstein.

See List of Advertisers on page 210

cal hot water use can be selected, or users can enter their own values. Sunheat1 is available for either the TRS-80 Model I Level II or the Apple II+, on disk or cassette. Price is $19.

Solartek, PO Box 298, Guilderland, NY 12084. Reader Service number 469.

Medical Package for The Apple

Medical Office Management II is designed to manage the physician's appointments, private patient billing, third party claim form preparation, diagnostic and treatment records, patient report preparation, mailing lists, referral letters and general word processing.

The insurance claim system prepares the universal claim form on a daily, weekly or monthly basis. The medical records element allows for the entry and organization of family or individual medical records with provision for selective printing or terminal display. Doctors can use the system to search for similar symptoms or diagnoses, or program the system to search for drug conflicts. Single-system license is $959.95. The appointment, private patient billing and claim form preparation elements are available separately for $449.95.

Charles Mann & Associates, 7594 San Remo Trail, Yucca Valley, CA 92284. Reader Service number 473.

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Software Resources, Inc., 186 Alewife Brook Parkway, Suite 310, Cambridge, MA 02138. Reader Service number 479.

Financial Modeling System

Plan80 is a modeling system for microcomputers that interactively produces bar charts and line graphs or tables to let the user project sales, analyze cash flow and build budgets. The user enters row and column definitions, data assumptions and calculation statements using any familiar editor or word processor. Assumptions can be changed interactively and the results recalculated at any time. Any part of one model can be incorporated into another. The user can compute functions such as depreciation, present value and internal rate of return. Plan80 is available for Apple, CP/M and UCSD systems. Price is $295.

Business Planning Systems, 2 North State St., Dover, DE 19901. Reader Service number 472.

Troubleshooting North Star

Software tools that aid in the diagnosis of North Star hardware and/or software problems are available from Valley Forge Software Group, 406 West DeKalb Pike, King of Prussia, PA 19406. Included are a full memory test (with Grey codes) and other stepped cycles to help isolate transient memory failure. A disk exerciser aids in alignment tests and functional operation testing. A serial port testing routine checks operation of ports set up in a loop-back configuration. The most powerful tool is the on-line, interrupt-driven software-debugging system. This module provides review and modification of memory, hardware registers and hardware ports, with multiple breakpoint addresses. The de-

bugger resides in memory with the North Star DOS and is capable of single-step execution of any 8080-based code. License per computer is $75. Reader Service number 476.

Disk Speed Measurement for the TRS-80

RPM measures the rotational speed and variation of disk drives on the TRS-80 Models I and III. Rotational speed errors are a common cause of problems, and variations in speed can cause intermittent, hard-to-detect errors. Readouts are given in real time as numbers, percents, words and graphs. RPM automatically shows speed ranges, and can recover from severe errors without a system reset. Price is $24.95.

Prosoft, Box 839, North Hollywood, CA 91603. Reader Service number 475.

Hands-On Learning

Block Shapes for Applesoft or Assembly contains programs to create and animate all types of shapes, such as vector shapes, block shapes, HPLOT shapes, text file shapes, data array shapes, and so on. This package is designed to help you learn more about graphics as you explore its possibilities. Most animation routines are in machine language, and the source codes for these routines are included. All source-code files are thoroughly explained and unprotected, and the machine-language routines are also unprotected. Cost is $99.95, on disks with documentation.

Avant-Garde Creations, PO Box 30160, Eugene, OR 97403. Reader Service number 477.

Word Processing Utility for Sorcerer

Roger Hagan Associates, 1019 Belmont Place East, Seattle, WA 98102, has released a utility program for use with the Exidy Sorcerer Word Processing System. WSORT is a high-speed Z-80 sorting routine. The sort is menu-driven, and it offers a choice of sort parameters. Any part or all of a file in memory can be sorted. WSORT turns the Exidy Word Processor Pac into a fast and convenient mailing list, bibliography, abstract, client file or other database management system. The program, with manual, costs $47.50. Reader Service number 478.

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The MCE and DCF packages run on the Apple II, TRS-80 and CP/M systems. MCE costs $75, and DCF is $125; both systems purchased together cost $149.

Centec Process Systems, Inc., Centec Building, 11260 Roger Bacon Drive, Reston, VA 22090. Reader Service number 481.

Two new business programs from Centec Process Systems, Inc.

↙See List of Advertisers on page 210

BOOK REVIEWS

Edited by Eric Maloney

Real World Interfacing
Soul of a New Machine
CP/M Handbook (Two Views)
Real Time Programming
Software Debugging
Fifty BASIC Exercises

Interfacing Microcomputers to the Real World

Murray Sargent III and
Richard L. Shoemaker
Addison-Wesley Publishing Co., Inc.,
1981
Softbound, 288 pp., $14.50

A book review should not just praise a book or bury it, but should match the book to a compatible group of readers. That won't be easy this time.

Interfacing is immensely enjoyable, if you are into both hardware hacking and programming. But it's for neither the beginner nor for the expert. Even though both authors are from universities (Optical Science Department, U. of Arizona), the book is written in a sometimes painfully informal style. I still haven't figured out what waveform corresponds to their "bashed in sine wave" description.

Other informalities may offend some, like the advice to the puzzled reader to get a friend to explain things to him. You might expect the book to do that, but in many instances, it won't.

The authors assume that the reader has some background in both electronics and programming. At least that is the result of the presentation. While such elementary topics as the pin-outs and operating principles of TTL logic are discussed, the discussions are so superficial that a newcomer could not learn the subject from this book alone. I don't think that self-instruction for beginners was the intent of the book, and there are certainly enough references to additional reading like Don Lancaster's *TTL Cookbook* to back up my suspicions.

Beginners would also get lost by the fragmentation of subjects and the scrambled organization of the book. Seemingly everything you would ever want to know to hook up micros to external devices ranging from fiber optic transceivers to stepper motors is covered, including software written in assembly language, Pascal and FORTRAN. Obviously, with so many topics, nothing can be covered in any depth.

Now for the good part. While nothing is covered deeply, there is a wealth of information in the book, if you have the background to understand it. If you have done very much interfacing between computers and the real world, you won't need this book, but you might enjoy reading it anyway. If you are a hobbyist, experimenter or recently graduated engineer with not a whole lot of hands-on experience, this could be one of the most valuable book purchases you could make.

Sargent and Shoemaker have provided an ideal sourcebook, giving an overview of the world of interfacing. So many aspects are covered that it would be impossible to begin listing them here. If you are ready to get into hooking your computer up to the outside world, and want it to run your lawn sprinkler, air conditioning system or operate your ham station for you, this book would be a good place to get started. Provided you have that expert friend handy to help you out.

If *you* are the expert friend, you might buy this book to help you explain things to beginners. You might even find a topic or two that you need to brush up on, or never got into yourself. In any case, you will find this book both entertaining and informative. And awfully informal.

Ken Barbier
Borrego Springs, CA

The Soul of a New Machine

Tracy Kidder
Atlantic—Little, Brown
Hardcover, 291 pp., $12.95

Journalists have had a hard time finding heroes to write about during the last couple of decades. A hero by definition is larger than life, and life in the latter part of this century has become too overwhelming to let us accept the image of the lone conqueror. So writers have turned their attention to groups of ordinary people who collectively do something extraordinary. David Halberstam wrote *The Best and the Brightest*; Gay Talese wrote *The Kingdom and Power*, about *The New York Times*; and Tom Wolfe wrote *The Right Stuff*, about the American astronauts.

Now comes Tracy Kidder's *The Soul of a New Machine*, an inside look at how a group of 30 or so engineers—half of whom were right out of school—locked themselves in the basement at Data General for over a year to build the Eagle 32-bit supermini. The book presents further evidence that on America's technological frontier, the heroes have turned in their fancy spurs and silver six-shooters for soldering irons and microcode. Their work is as unspectacular as the gray walls surrounding them, and in the end the machine gets the glory. The satisfaction our computer cowboys get is personal, com-

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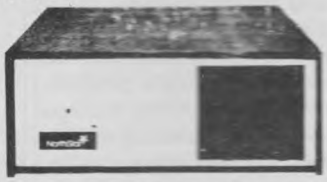

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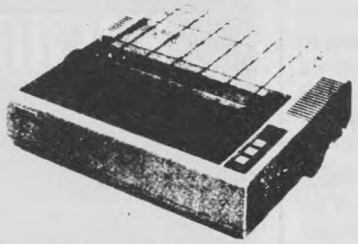

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The most revolutionary thing about the Epson MX-80 isn't the bidirectional printing or the logical seeking function. It isn't even the disposable print head - although that's pretty revolutionary. The most revolutionary thing about the MX-80 is the price.

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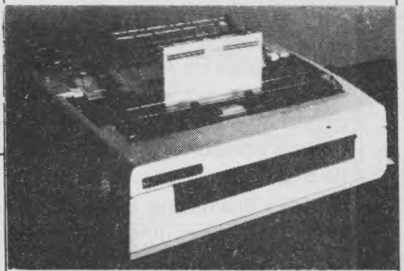

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MICRO MERCHANTS Division Comtek Electronics, Inc.

ing primarily from the knowledge that somewhere in that hardware and software is their signature, some final product of their sweat and skill.

The book reads like a computer version of *The Magnificent Seven*. DG engineer Tom West puts together a team to come up with an answer to Digital Equipment Corp.'s VAX 32-bit mini. Some are young kids with peach fuzz on their faces; others are grizzled veterans of previous computer wars. They know it's going to be a dirty job—long days and nights, no sleep, no weekends off, low pay. But they're driven by the need to make something bigger than themselves.

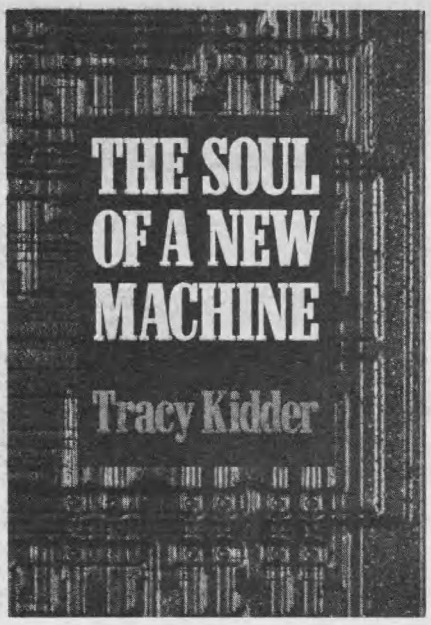
Kidder's account of the sacrifices made by the Eagle's creators will come as no revelation to anyone who has given himself up to a major project. But the average reader cannot help but be awed by the staggering amount of work and time necessary to build a major new computer. The volumes of paperwork, the rooms full of equipment, the endless detail, the excruciating debugging process—all conspire to show how much the computer transcends in complexity the abilities of any one person. While each of West's engineers responds to the task of building the Eagle in his own distinct way, the computer dominates. Only a few of the personalities Kidder describes project images that survive the machine by the book's end.

Despite the preeminence of the computer, Kidder succeeds in showing the human side of its invention and construction. We see engineers succumbing to the pressure and leaving the project; we see them playing Adventure at 4 AM; we see them fighting, yelling and laughing their way through the long arduous months. If the project is cold and logical, its workers are not; they use every trick and tool at their disposal to complete the best machine possible in the shortest amount of time, and their tool kit includes no small amount of luck and intuition. As Kidder points out, no matter what the corporate motivations for building the Eagle, "It seems more accurate to say that a group of engineers got excited about building a computer."

One of the most satisfying qualities of this book is the elegance Kidder lends it. *The Soul of a New Machine* is no kludge—Kidder is a professional wordsmith, and it shows on every page. He explains how a computer works, in simple and understandable terms, yet in a way that reveals something about the project and its engineers.

When discussing ROMs, for example, Kidder describes how West once jokingly called coworker Carl Alsing "a ROM-driven man." West then made up a song to the tune of "John Henry."

"West was always inventing catchy expressions, and 'ROM-driven' was Alsing's favorite," Kidder writes. "The contents of a ROM, once programmed in-



to the chip, cannot be altered or erased; the information can only be 'read.' *ROM-driven*: it opens up the ancient question of predestination and free will. Later, Alsing would wonder how the phrase applied to his friend. So would West himself, apparently, for one day downstairs, during the Eagle project, he would ask—laughing his nervous-sounding laugh, not the hearty one of the pig roasts—'Doesn't anything around here happen by accident?' "

Ultimately, the book arrives at the Big Question: What motivated the members of the Eagle team to give so much to a machine, one that would no doubt be eclipsed by something better in a few years? Kidder anticipates the question near the end of the book, but the answers he suggests are nothing that would encourage a college freshman to take computer science courses. They involve such intangibles as self-fulfillment, a feeling of accomplishment, self-satisfaction. Rosemarie Seale, the team's secretary, perhaps summed it up best:

"The bottom line on this is that effort was done; it was done well, with very little help from the corporation, if any; a lot of people were allowed to grow; a lot of people were allowed to feel good about themselves—not a pat on the back—but deep-down good about themselves. I guess all of us were trying to prove something."

Eric Maloney
***Microcomputing* staff**

The CP/M Handbook With MP/M

Rodnay Zaks
Sybex, Berkeley, CA, 1980
Softbound, 336 pp., $14.95

When you spend over $200 for an operating system, you shouldn't have to spend another $15 to learn to use it. Unfortunately, the documentation of CP/M is both exhaustive and exhausting. Zaks has taken all the material, distilled the essence and presented it with style.

The first chapter can stand by itself. It is all that a nontechnical person needs to run a CP/M-based system. Zaks starts at square one and briefly describes all the parts of a computer system—even what a disk is and how it works. From there he goes on to explain running a program, writing to files and simple file manipulations such as opening, closing, renaming and erasing. He also covers reading the directory and printing a listing.

The second chapter goes a step deeper by describing inherent CP/M commands such as STAT, SAVE and REN (rename). It then deals with transient commands such as PIP, SYSGEN and MOVCPM. The treatment is not exhaustive, but it's sufficient for the first-time user. Tables and charts explain control characters and various combinations of commands.

The next two chapters alone are worth the price of this book. They describe PIP (peripheral interface program) and ED (text editor program). These chapters are useful for two entirely different reasons. PIP routines are commands that give CP/M much of its power, but they're difficult for both novice and veteran users to understand. Zaks leads you through them step by step. The ED program is described by Zaks as a minimal text editor—the nicest thing that I have heard it called. He suggests that you buy another text editor. However, he does go on to make the most of this program, and by the time I had finished the chapter, I was prepared to use ED.

In the next two chapters, Zaks describes the mechanics of CP/M including memory, disk maps and summaries of all the commands in versions 1.4 and 2.2 as well as MP/M. These are invaluable to a serious programmer. Once again they are present in Digital Research's documentation but are difficult to find.

The final two chapters are the icing on the cake. Zaks gives his own practical hints on the operating system. Even old hands will appreciate them.

I recommend *The CP/M Handbook* to everyone interested in CP/M, to everyone about to buy the system and to everyone who already has it and is either lost or thinks he knows it all. Fifteen dollars is a lot to spend for something that should have been supplied, but this book is worth every cent.

Bruce Evans
Pickering, Ontario

If the manuals supplied by Digital Research weren't confusing, this book would not be needed. Unfortunately, Rodnay Zaks continues in the footsteps of Digital Research with a book that does

all it can to completely confuse the reader in Chapter 1.

Assuming that this book will be bought by either a prospective or an inexperienced user of CP/M, the reader will be lost before finishing page 6. Topics covered include two versions of CP/M, one of MP/M, Cromemco's CDOS, PIP, ED and BASIC. More confusion continues from page 7 to the end of the first chapter, with the author throwing everything at the reader from "How to Turn on the Cromemco" to WSU.COM and WSMSG.COM!

If the reader does manage to struggle through Chapter 1, he then enters the area of incomplete topic coverage and outright misinformation. (I have two pages of notes on errors included in this book.) Of course, the book has a lot of usable information, but a first-time user of CP/M is not going to know how to find it, and won't have any way of filtering the good data from the bad.

This is all the more disturbing because Zaks started out with the right idea in mind: set down a set of simple instructions for the nonprogramming user of CP/M. Why he then gets bogged down in the intricacies of PIP in the first chapter is beyond comprehension. This pattern is continued throughout the book. Some topics are covered in needless detail; others are totally ignored. To confuse the reader struggling through the useful data, there are continual references to too many versions of CP/M, and instructions for MP/M which should have been segregated into an appendix or another book altogether.

The microcomputer world certainly has a need for a CP/M handbook. This isn't it.

Ken Barbier
Borrego Springs, CA

Real Time Programming—Neglected Topics

Caxton C. Foster
Addison-Wesley Publishing Company, Inc., 1981
Softbound, 190 pp., $8.95

If I were teaching a class in interfacing, this would be my text.

If there is no class on interfacing, this can be your text.

Most of us in the home computer field did not perfect our skills under the auspices of the local state college. Digital electronics was learned from magazines, and interfacing was learned with soldering iron in hand. Just why a CMOS chip disintegrated before your eyes, or why that TTL chip output noise instead of a signal, were the kinds of things that there were no teachers around to tell you. What are pull-up resistors? What is the best combination of hardware and software?

Those of us still with it must have loved it, but are painfully aware of the fact that there is still a shortage of the kind of information that newcomers to the computer field need. A B.S. in Computer Science does not usually mean that the holder of same knows anything about digital design, or peripheral drivers or interfacing to the *real* world. Only this year have a few colleges started offering microprocessor computing degrees that address these topics. I don't know what they are using for classroom texts, but if most of the students had this book, they probably would be spending their money on parts, and gaining some real experience, instead of taking the course.

If you open to the back of the book first, you will be scared to death of what you see. The cure for that is to open to the front of the book. Take it in order, at your own speed, one concept at a time. This book was put together by a master. Don't ruin his good work by jumping the gun.

All that is required is a grade school knowledge of electricity, a bit of algebra and some familiarity with the fact that CPUs have registers and instruction sets that do the work in a computer. It doesn't matter what chip. The 6502 and the Z-80 are used for examples, and assembler codes for both are explained. Where it applies, each example is shown in both instruction sets.

When a component is used in a circuit, the component is explained in a separate block of text. New concepts are also explained this way. The examples of how to use these devices and techniques are taken right out of the real world. Where a knowledge of the mathematics involved is helpful, the equations are carefully explained. The chapters and topics have been arranged so that the math builds upon what has already been discussed. This lowers the possibility of biting off more than you can chew.

When you've finished the book, you should have a good working knowledge of how to go about hooking your computer up to the world. Though the book starts with simple interrupts and port addressing, it soon works up to ac and dc control, testing and measure, and digital communications. You won't be an expert without a lot of actual building experience, but you'll know how to go about working on the problems that confront you, whether you are building a robot or sending electronic mail.

Mr. Foster has created a masterpiece. I am, quite simply, flabbergasted.

Dennis Thurlow
Peterborough, NH

Software Debugging for Microcomputers

Robert C. Bruce
Reston Publishing Co., 1980
Hardcover, $17.95, paperback, $10.95

Many books describe how to write a structured program, but few have been written exclusively about debugging. *Software Debugging for Microcomputers* fills the gap.

The author describes how to write a flowchart, how to transform the flowchart into a BASIC program and how comments aid in the debugging process. He also gives guidelines for where and how many comments should be inserted in a program.

The book covers six debugging techniques, including something called "playing computer." This is a form of debugging that is done before a program is entered into the computer. The programmer places himself in the role of the computer and executes the program. This helps him find logical as well as syntactical errors.

One chapter covers the use of print statements as a debugging aid, while another introduces the technique of "forcing," where the programmer tries to execute every branch to ensure that the program handles all cases. Bruce admonishes that the input to the program be devised so that the output is as easy to verify as possible.

Chapter 6 covers block debugging, a useful technique when you're trying to debug large, segmented programs. Bruce introduces the concepts of a "stub" and a "driver."

Chapter 7 deals with a debugging technique called "snapshots," with which the programmer is able to see large volumes of debugging information in a manageable form.

Bruce also discusses the advantages of inserting sleeping debugging statements into a program. This saves much time when a program needs to be modified.

Patches are covered in chapter nine. Sometimes a programmer encounters a bug that he can't fix. When this occurs, some program lines are inserted to circumvent the error. This type of debugging should be done only as a last attempt at eliminating the error.

All the techniques are used when Bruce goes through the debugging of a program in the last chapter. The reader can see how each technique can be best used.

Bruce has done a good job explaining debugging. The techniques shown are easily used with other computer languages. *Software Debugging for Microcomputers* will make a welcome addition to any programmer's library.

Ronald Brandow
Troy, NY

Fifty BASIC Exercises

J. P. Lamoitier
Sybex
Softbound, 231 pp.

J. P. Lamoitier states that "the most effective way of learning a programming language is through actual practice," but

I doubt that any beginning level BASIC programmer will be able to practice using this book alone. *Fifty BASIC Exercises* introduces you to Armstrong numbers, Egyptian fractions and the Fibonnacci maximal algorithm, but it doesn't give you a reasonable explanation of nested loops. It dives into the use of subroutines in program examples without an adequate explanation of a subroutine or general methods to properly use them.

Lamoitier omits many important programming concepts such as the CLS command and the logical AND and logical OR functions. Arrays are covered briefly, but a more detailed explanation is needed before a novice programmer could use them.

The author states that "all of the programs in the book are written in Microsoft BASIC and will execute directly on a TRS-80. . . ." However, it is unclear which level of the TRS-80 he is referring to. For instance, Lamoitier states that there are only 26 string names available consisting of a letter of the alphabet coupled with the dollar sign. This would seem to indicate the Level I but the programs freely use features found only in Level II, such as the square and exponentiation functions.

This book does have some strong points. An outstanding effort is the directory program in Chapter 5, which demonstrates sorts in an interesting way with a well-documented example.

While any single volume can't be an encyclopedia, I would trade off casual mention of skewness and kurtosis for a definition of ASCII or the fact that DEFINT and DEFSTR exist. As a reference volume on BASIC it deserves consideration only if you already own two or three good books that concentrate on giving you the ability to understand the fundamentals of BASIC programming.

Allan S. Joffe
Dresher, PA

New and Noted

Build Your Own Z-80 Computer. By Steve Ciarcia. Byte Books/McGraw-Hill. Softbound, 332 pp., $15.95. The author of the popular "Ciarcia's Circuit Cellar" in *Byte* magazine tells you how to build your own Z-80 computer.

Computer Graphics. By David Chance. Tab Books. Softbound ($8.95) and hardbound ($15.95), 280 pp. With 29 programs for the TRS-80.

The 8085/SDK-85 (Hands-On): 54 Control Experiments. By Howard Boyet. ITM Publications. Softbound, 394 pp., $19.95. Presents "new areas, applications and topics of a more advanced nature not covered in volume 1."

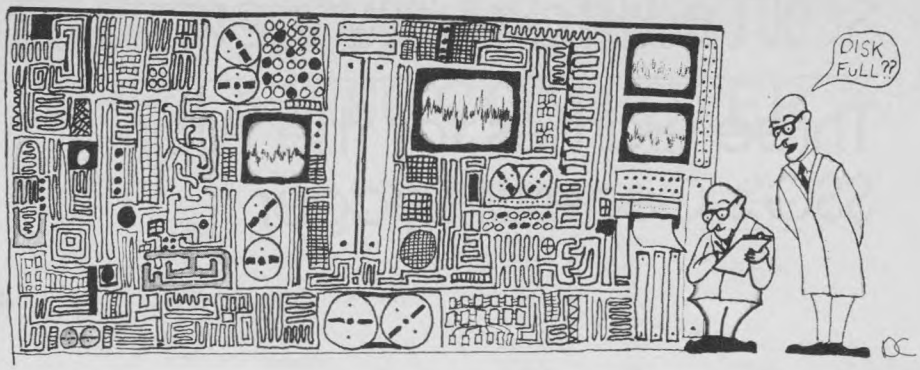
Information Technology and Health Care: the Critical Issues. Karen Duncan, ed. AFIPS Press. Hardcover, 144 pp. Material derived from 1979 National Computer Conference Symposium on Issues in Health Care Computing.

Packet Radio. By Robert Rouleau and Ian Hodgson. Tab Books. Softbound ($11.95) and hardcover ($18.95), 304 pp. Book for both amateur radio fans and computerists on "principles and potentials of this innovative technique for high-speed, multi-user access to data resources."

Playing the Stock and Bond Markets with Your Personal Computer. By L. R. Schmeitz. Tab Books. Softbound ($9.95) and hardcover ($16.95), 308 pp. Stock selection, buy-sell decision-making, market evaluation.

The 16-Bit Microprocessor Handbook. Edited by Blacksburg Group. Group Technology, Ltd. Softbound, 350 pp., $14.95. From the Blacksburg Continuing Education Series. Covers 8086, Z8001/2, 68000, 9900, LSI-11, 16032; includes software benchmarks.

34 More Tested, Ready-to-Run Game Programs in BASIC. By Delton T. Horn. Tab Books. Softbound ($7.95) and hardcover ($12.95), 224 pp. "All kinds of fun things to do on a home computer!"



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Three Games for the Atari
SSG's General Ledger

Three Games for the Atari

One of my pet peeves about computer card games is that they don't often truly simulate play as it would occur in real life. This is particularly the case with blackjack. Much of the time a single player competes with the computer/dealer. The computer often deals from a single deck, uncut and poorly shuffled. Finally, you can't ask your fellow player for advice.

Casino Blackjack/Counter from Manhattan Software is an exception. It lets you play with one, two or four decks. (Many casinos use two or four decks to minimize the effectiveness of "counting.") The deck(s) is then shuffled and cut. The cut gives the dealer a random place to reshuffle, another technique used to discourage counting in some casinos. Play then begins: the computer acts as dealer and four other players. Your hand is displayed in the center of the screen.

You use the joystick to select the number of decks to be used, to place a bet, and to indicate what actions are to be taken during the deal. All the standard options are available to the player: insurance bets, splitting and doubling down. There is a 3-for-2 payoff for natural blackjack, and the dealer must hit on 16 and stand on 17, standard casino blackjack rules.

One of the ideas of this game is to help practice point counting. At any time when a bet is requested, you can select the option SEE POINT COUNT. The present count is displayed along with a suggested bet based on a simple system described in the documentation. If the current deck is nearly exhausted, a message warning that it may be necessary to reshuffle during the current hand is displayed.

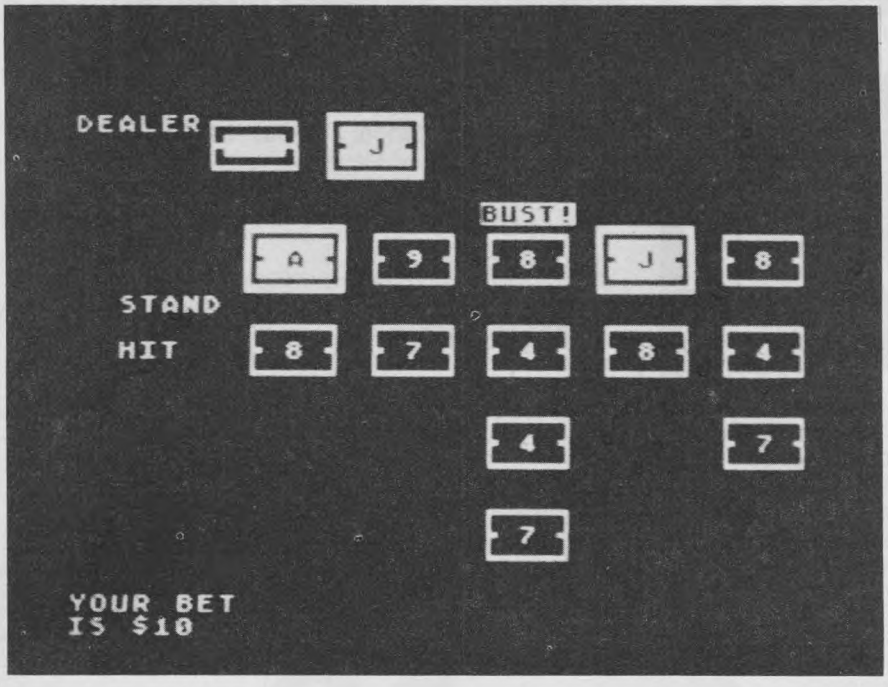

Photo 1. A scene from Casino Blackjack/Counter: I've just gone bust with 23. Note the options I had displayed at the left of the screen.

Casino Blackjack/Counter is a well written program and deserves a place in the library of anyone interested in playing blackjack.

Labyrinth Run looks simple. Indeed, the first portion of the simplest maze can be negotiated by even the most palsied hand. However, the slightest inattention results in a devastating crash, complete with loud embarrassing sounds of destruction.

Labyrinth Run is a fantastic game. The object, of course, is to get a runner through a maze in the shortest possible time. This simple goal is complicated by several factors. First, the runner moves rather quickly. Second, the mazes are cunningly designed with deceptive, easy stretches leading into tricky ones. Frustrations built up from many crashes then result in still more crashes after passing through the difficult section.

Labyrinth Run has three separate mazes, three levels of play, and a very interesting option, revolving doors.

All three mazes are designed to make you crash into the walls rather than to be difficult to solve. The first two involve the usual 90 degree turns. Number three has strange angles and is virtually impossible to get through except when playing at the highest skill level, which allows diagonal motion. Unfortunately, only the lowest skill level, novice, allows you to continue after a crash (though with a time penalty). Thus, the slightest error or lapse of vigilance results in sudden death for the runner.

After developing a little confidence with one of the mazes, it's fun to try the option, revolving doors. Toward the end of the maze there appear a pair of moving walls that open and close the path one must take to reach the end of the maze. It requires a combination of luck, good timing and a steady hand to get through.

Finally, here and there in each of the mazes are openings just wide enough for the runner to pass through. These pro-

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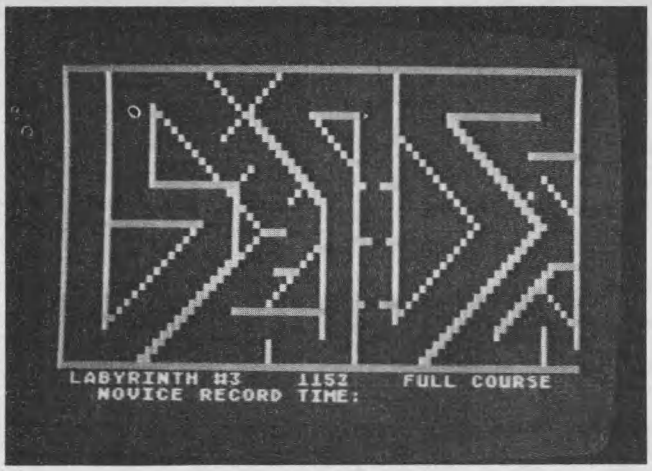

Photo 2. Course 3 of Labyrinth Run. The "runner" is at the far right of the screen just above center.

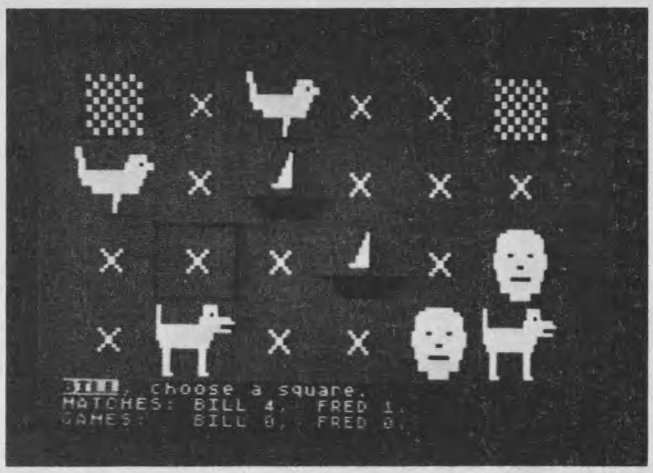

Photo 3. A moment in Concentration when I'm actually beating my roommate.

vide time-saving shortcuts, but the problem is hitting the hole rather than the wall.

This is an excellent game, particularly for parties. It's fun to watch the times gradually increase as the supply of alcoholic potables decreases. (The determination of the players also seems to increase as their ability to coordinate eye and hand decreases.)

Concentration is a computerized version of the old television game. The object of the game is to match pairs of objects. Since this is a two-player game, the winner is the one who has made the most matches when all the objects have been revealed.

The game is simple to play. You move a box around the screen and when it is positioned on the square you want to reveal you press the fire button of your joystick. You then select a second square in the same way. If the revealed objects match, you get a point, the objects stay on the screen, and you get another chance. If they don't match, both are concealed again and your opponent tries his memory.

As you can see in Photo 3, this game makes excellent use of the Atari color graphics capability. There are a number of levels of play; the more objects there are to match (up to 12), the more difficult the game is. The game is fun for adults at the high end and is particularly good for young children at the lower levels. This is a game that can be a challenge at any age level.

William Colsher
Lisle, IL

Ordering Information

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Structured Systems Group, Inc.'s General Ledger

The GFS Micro-Computers partnership was formed to do data processing for a small CPA firm. We needed a general ledger package that would be adaptable to different clients from different sized firms would be easy to learn and use and would have as much error detection ability as possible.

Since my teaching duties at Clarkson College include teaching an introductory course on computers and BASIC programming, I was elected to do most of the legwork. I chose General Ledger (Structured Systems Group, Inc., 5204 Claremont, Oakland, CA 94618), and I have never regretted it.

Although the introduction to the manual states that the General Ledger is written for CPA firms, it is so flexible that it can be adapted to any small business—if the business seeks help from its accountant in the initial setup.

The General Ledger is a menu-driven package written in CBASIC-2 to run on computers using CP/M, but it is no longer necessary to actually own the CBASIC language program. SSG has developed its own system including CBASIC and the programs written in CBASIC. This SSG system is called Itworks, probably, I suspect, because it does. Running SSG's General Ledger is as simple as inserting the proper disks and typing GL and the date, although the date will be requested at a later time if it is not entered to start the program.

Parameter System

General Ledger uses parameter files which must be entered at least once and may be changed as desired. These files contain basic information, such as company name, name of statements to be produced, size and type of paper and other report characteristics. The General Ledger will not run if parameter entry is not completed, and the program lets you know this in no uncertain terms by requiring entry at the first menu. One of the best features of SSG's General Ledger is its ability to detect errors, such as programs run out of sequence or lack of parameter files, and to refuse to go on until these errors are corrected.

Chart of Accounts

The General Ledger requires you to enter a chart of accounts, which is a list that assigns account numbers to the accounts which will be used. This step is crucial, because the output statements—Income Statement, Balance Sheet and Statement of Changes in Financial Position—are formatted by the numbering system chosen for the chart of accounts. It is at this point that a friendly accountant should be consulted, since the chart of accounts and numbering system will determine the usefulness of the statements both to the company and to outside users, such as bank loan officers.

As part of this initial setup, SSG has included the ability to generate sample statements that show the format of the balance sheet and income statement without you entering monetary amounts. The program generates the monetary amounts, but it must be noted that these sample statements will not balance, as the amounts are entered only to demonstrate what the statements will look like.

Transaction Entry

Once the chart of accounts is finished, it is possible to begin entering batches of transactions. Journal Entry is chosen from the menu, and a minimenu with a choice of two journals appears: General Journal for most transactions and Cash Disbursement for entries from a checkbook. The technique used is called form-filling, since the cursor moves to the proper screen position as required, and the spaces can easily be filled in and verified. Once again, SSG has designed superior error-catching programs, so the only mistakes that can be made are human—

miscopying data or misentering references. However, two running balances at the bottom of the screen make it possible to spot errors.

The next step is to print a proof sheet, which lets you make another comparison with the original documents. When you are satisfied with the journal proof, the journal batch is posted to a detail file. A trial balance and two different types of ledger reports can then be generated, but the period cannot be closed, and statements cannot be printed, until the detail file balances.

After the period is closed, the three statements may be generated, with the journal proof sheet, the trial balance and ledger reports acting as a hard-copy audit trail. Accountants will appreciate the audit trail, while management will appreciate the usable statements.

Other Features

There are other features which are useful in certain instances, such as multiple profit center and branch reporting. An example of a use of multiple profit centers would be to separate a retail store into departments; an example of branch reporting would be when a firm has more than one location and wants the income from these reported separately. Unfortunately, these options cannot be used simultaneously, but it is possible to adjust the chart of accounts to simulate either a multiple profit center or a branch.

A feature which is extremely important to the accountant is the Statement of Changes in Financial Position, which is required by Generally Accepted Accounting Principles along with the Balance Sheet and Income Statement. The Statement of Changes is difficult and time-consuming to develop manually, but the SSG General Ledger makes it simple, as it generates the entire statement within a matter of minutes.

Because of the batch transaction system used in the General Ledger, the posted detail file must be sorted by chart of account number, and the chart of accounts itself must also be sorted. SSG has included in the package a version of the QSORT, which does an efficient job of handling the necessary sorts.

Structured Systems Group offers a unique service called the Software Maintenance Plan. For a monthly fee, the user is entitled to updates as they are issued and to answers to questions which the user or the dealer cannot answer. The people on the SSG Hotline are cooperative and knowledgeable about their products.

Conclusions

I am pleased with the Structured Systems Group's General Ledger. It has done everything I could have wanted, and has never failed to impress me with its versatility. It is, however, necessary to comment on the questions of whether it is easy to use and easy to learn.

As with any computer program, this one is easy to use only after you have gone through the manual thoroughly and worked with the program. The manual could use some improvements in explanations and diagrams, as well as an index, but I am sure SSG will revise it when possible.

Meanwhile, the initial setup is the most involved part, and this must be done carefully, since the quality of the reports generated depends on the setup. As stated before, I recommend seeking the help of an accountant at this point, and when it comes time to close out the year—although this is for accounting purposes and not because the General Ledger requires it.

Once the chart of accounts is entered, the rest of the program runs well, is easy to learn, easy to use and comprehensive. All in all, the Structured Systems Group's General Ledger is a satisfactory package for business data processing.

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(continued from page 242)

well as any travel expenses related to attending the classes if such expenses were not reimbursed by his employer.

Documentation of all expenses will be required if E wishes to claim such items as employee business expenses. A letter by his employer may be required to justify the need and use of the computer as well as specimens of the work produced. Travel expenses can usually be documented by a mileage log or a similar instrument. Education expenses are usually deductible if they improve skills required by the present job, and do not qualify the individual for another job and are not taken to meet the minimum requirements for the present job.

Publications 508, 529 and 587 from the IRS can provide some additional information on employee business expenses.

Tax Preparation Expenses

The IRS allows a deduction to be made for any reasonable expenses related to the preparation of individual income taxes. If you purchase books, computer programs or use your computer for the maintenance and computation of income tax information, such expenses are deductible.

Ms. R is an executive with a large corporation and incurs a substantial amount of expenses relating to her job. She decides to purchase a microcomputer to help her maintain records on those expenses. In addition to the computer, she also purchased assorted software packages which will be used to assemble and calculate her taxes for the year.

The system costs $2500 and she figured that it would pay for itself in a few years because her accountant normally charges $1200 per year to assemble the information for her.

The IRS allows a deduction to be made for tax preparation expenses. Tax preparers typically charge anywhere from $20 to $500 for the preparation of individual income taxes. If a taxpayer elects to prepare his or her own taxes with the aid of a computer, such expenses are deductible if they are reasonable. There is no set formula, but common sense should dictate whether or not an expense is reasonable. Also note that if the computer is only used 10 percent of the time for tax purposes, only 10 percent of the expenses should be deducted.

Computer software and manuals for the preparation of taxes are generally fully deductible provided that it is within reason. A person preparing a short form will not need to spend $200 for preparation material, while a person with a business may easily spend $500.

Tax preparation expenses and/or fees are deductible only if you itemize deductions. Persons using the short form will not be eligible to deduct tax preparation expenses.

Investment Expenses

If a computer is used to maintain records on individual investments, the expenses are also deductible. Typical applications may include using the computer to monitor a stock portfolio or the financial status of income property. The same rules apply to investment expenses as tax preparation expenses.

Investment Credit

If you buy certain new or used tangible personal property (computer and peripheral devices) with a useful life of at least three years for use in your job or business, the equipment qualifies for a credit of up to 10 percent of the cost of the qualifying property (form 3468).

Ms. C purchased $5000 worth of computer equipment for her software company and she expects to use the system for at least seven years. The equipment will qualify for a 10 percent investment credit of $500. The tax credit will result in a reduction or refund of $500 to Ms. C.

The investment credit is based upon the expected life years of the qualifying property. A maximum credit is given for equipment with a life of seven years or more. For more details on computing investment credit, see IRS publication 572.

Capital Gains and Losses

A capital gain or loss is realized when you sell property that was held for trade or business.

Ms. C decided to sell one of her computers because the manufacturer went out of business and the computer was not supported by any local dealer. The computer cost her $2000 and she was only able to sell it for $200 because it was no longer in demand. She may deduct a loss of up to $1800 on the transaction if the machine was used in her business.

Different methods of calculating the loss would be used if the machine was held for more than one year and if any depreciation was claimed. Details on how to claim the loss are included on schedule D.

Depreciation

If you plan to deduct expenses from the use of computer equipment, such expenses must be "capitalized" over the life of the equipment. This is commonly referred to as a depreciation expense. A simple formula for computing depreciation is as follows: cost – salvage value ÷ life.

For example, if cost = $5000, salvage value = 0 and life = five years, then depreciation expense for year 1 = ($5000 – $0) ÷ 5 = $1000.

The example shows a straight line depreciation. There are several other methods used in calculating depreciation expenses. It is a fairly complex area and is beyond the scope of this article. If you qualify for a depreciation deduction for your computer equipment, consult an accountant or tax attorney for a determination of which method to use.

Tax Planning

If you are planning to purchase a computer and/or enter into a business which will use computers, some advance planning can save you significant amounts of money. In order to claim the deductions outlined in this article, you must be able to document all expenses as well as detail their use. Even if you are purchasing a computer strictly for hobby use, save all receipts because if you enter into a business later that year, you can deduct a percentage of the computer use.

If you plan to lease a computer system, make sure that the lessor elects to pass the investment tax credit to you; otherwise, you can lose up to 10 percent of the cost of the system.

For 1981, there have been several proposed changes in the tax laws which will provide more favorable tax treatment of equipment purchases. Once these laws have been enacted, the changes should be taken into account when determining depreciation and investment tax credits.□

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Internal Revenue Code, U.S. Government Printing Office.

Publication 17: Your Federal Income Tax, (an expanded instruction booklet for completing form 1040 free for the asking from the IRS).

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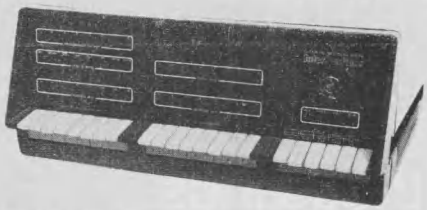

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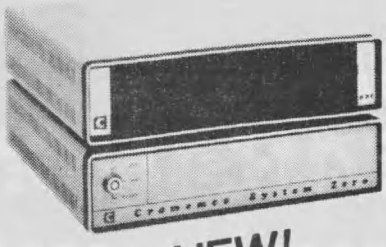

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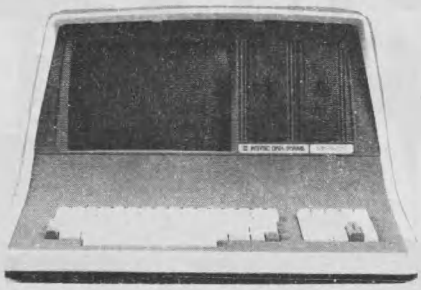

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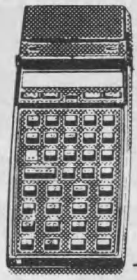

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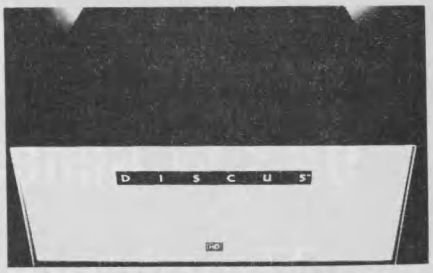

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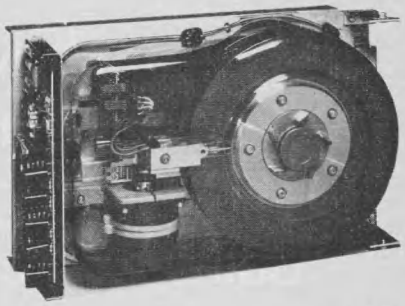

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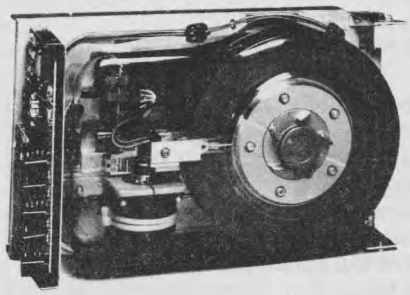

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By Hoy Quan

The IRS And You

Tax Guide For Micro Users

As we approach the end of the year, it is time to begin thinking about calculating our individual income taxes. Software vendors are promoting microcomputer income tax programs that promise quick and easy relief from the burden of doing our taxes. They may save us some time, but rarely do they save us any money. However, computers *can* save us money when it comes to income taxes.

Home computer owners will have invested anywhere from $300 to $30,000 in their systems. Such expenditures can have significant tax implications if you are careful in planning your purchases and documenting their use. The IRS offers very generous tax credits and deductions if you qualify.

Deductions are allowed for profits or losses from a business or profession, capital gains and losses, employee business expenses, tax preparation expenses and investment fees and expenses. If you use your computer for any of the activities listed above, you can qualify for deductions of part or all of the expenses relating to the use of your computer.

Profits or Losses From a Business or Profession

Schedule C is the form you fill out to document any profits or losses from a business or profession. If you provide any type of service, or engage in any type of sales activity which utilizes the computer, you can deduct those expenses from your income. A qualifying business does not have to be a full-time activity and may be operated from your place of residence (for example, consulting, producing software and selling computer equipment and supplies).

If you are operating the business on a part-time basis, any losses you incur can be deducted from income derived from other sources such as salary. Also note that if the business becomes very successful, all profits must be added to your income.

The IRS imposes strict rules on deducting losses from hobby activities, so you must substantiate the business nature of your activities if you plan to deduct losses from a computer business. The following criteria apply:

The manner in which the activity is operated. Is it conducted in a business-like manner? Are there indications that a business actually exists (business license, cards, letterhead)?

The expertise of the owner. Is he/she qualified to conduct such a business?

The time and effort expended. Are business activities actually conducted and to what extent?

The relationship of profits earned to expenses and losses. Is revenue generated from the activity or is it operating at a total loss? If there are excessive losses, the business becomes questionable.

The financial status of the individual. Does he expect significant additional income from the activity?

Elements of personal pleasure or recreation. Is there a serious intent to conduct a business?

A general rule used by the IRS to determine whether or not the activity is a business is the profitability presumption. If the activity shows a profit in at least two out of five years, then the IRS bears the burden of proving that the activity is a hobby rather than a business or trade.

Ms. C is an elementary school teacher who decided to start a part-time business producing educational software for microcomputers. She purchased two computer systems at $2000 each, a printer for $1000, $500 in disks and paper and $500 in books and technical manuals. She also incurs expenses for obtaining a business license ($50), letterhead stationery and business cards ($100) and travel expenses ($500). She received $200 for providing tutoring in computers and $500 from the sale of a program.

The activity is conducted as a business, and during the year she incurred expenses totaling $2650 and received $700 in income for a total net loss of $1950, which may be deducted from her salary as a teacher. Note that the total cost of the computers and printer ($5000) cannot be deducted during the first year but is depreciated.

For further information regarding the tax treatment of hobby/business activities, consult sections 162, 183 and 212 of the Internal Revenue Code.

Employee Business Expenses

As an employee, you may deduct certain expenses related to the use of a computer in your job (form 2106). Materials, supplies, publications, journals, supplementary education and computer expenses can be deducted if you meet necessary requirements.

Mr. E, a programmer with Acme Software Services, is assigned to a project that involves the preparation of a financial forecasting model for an important client. The project will be due in five months. E discussed with his supervisor the possibility of having Acme lend him a computer so that he may do some of the work at home. Acme could not release their computer, but E's supervisor suggested that it would be a very good idea to do some of the work at home since it was an important job. E later purchased a microcomputer to assist him in writing the program. At the same time, he also enrolled in an economics and advanced computer programming class at a local university.

E may deduct a portion of the computer expense, computer supplies, tuition, books and materials for the classes as

(continued on page 238)

Hoy Quan is a consultant for COMTEC, 891 Ashiya, Montebello, CA 90640.

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